TELEPHONE ENGINEER

Vol. V CHICAGO, MAY, 1911 No. 5

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Why is the galvanized wire business so good and the copper wire business so bad?

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How are they economizing?

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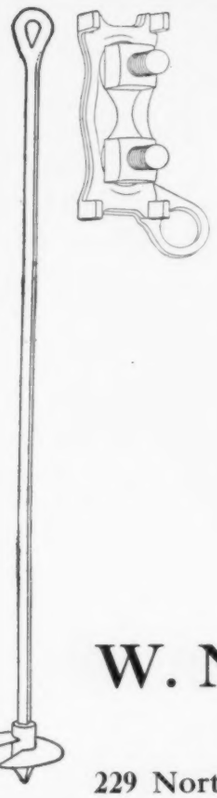

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ESTABLISHED 1902

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CHICAGO, MAY, 1911.

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A. T. & T. ANNUAL REPORT.

FEATURES of the American Telephone and Telegraph Company's annual report for 1910 are its commendation of commission control or regulation, its condemnation of physical connection, and its open advocacy of a single, universal system for the transmission of intelligence by electrical means, whether telephone, telegraph or cable.

The directors of A. T. & T. emphatically disapprove of physical connection. Their arguments against it are many; some obviously prejudiced, others rather impressive and demanding analysis. Proper consideration of these points demands some space, and we will defer them until another time.

Every year A. T. & T. evolves new arguments against telephone competition. Against telephone competition without interconnection little argument is longer needed, and firing broadsides against it seems rather a waste of good ammunition. Even the "old-school" independents are ready to admit, in most cases, that competition of the "kill or be killed" sort is commercial extravagance and undesirable from any standpoint. Competition with interconnecting arrangements, however, is another matter, and economically good, we insist, in spite of Bell animadversions.

It is in the division or chapter headed "Telephone and Telegraph" that reference is made to "the combination of every kind of electrical transmission of intelligence into one system." An ambitious project.

The subject of depreciation receives considerable attention, though nothing specially new is brought out. Schemes for the benefit of employees in the way of pensions and savings are mentioned and being considered.

Subscribers added to the Bell system during the year are reported as 740,027, making a total of 5,882,719, of which 1,852,051 belonged to connecting companies. Wire mileage of 1,162,186 was added, the total of 11,642,212 miles being an all-Bell figure. The total daily average for the year was 21,681,500 exchange connections and 602,500 toll connections, as against 19,925,000 and 517,000 in 1909. The amount added to plant in 1910 was $53,582,818, and new construction for 1911 is contemplated to the approximate value of $60,000,000. Maintenance and reconstruction for 1910 cost $52,028,000 and provision for depreciation $26,200,000. Gross revenue for the year was $165,600,000.

The relation between the Bell system and the Western Electric Company has fostered one peculiar condition. Investigations made by commissions and public bodies bring up a question as to possible abnormal profits enjoyed by the Bell through its apparent opportunity to enter excessive charges for apparatus and supplies. Such investigations, of course,

prove the groundlessness of suspicion; but they place the manufacturing concern almost in the attitude of being itself a public utility, and under partial supervision.

Total outstanding obligations of the Bell system are shown to be $580,000,000. The book value of its property is $696,700,000. In all cases of official appraisement, however, it is stated that actual values have been found to exceed book values.

Construction costs per exchange station are $117.12, or $142.13, includinrg toll line values. In 1900 the equivalent figure was $199.

Taken as a whole, the A. T. & T. report for 1910 is optimistic in tone and shows not only that the telephone business is a good business, but that it is constantly growing better.

PUBLIC VS. PRIVATE OWNERSHIP.

THE latest addition to the estimable Harvard Economic Studies in a volume entitled "Public Ownership of Telephones on the Continent of Europe," by A. N. Holcombe. It is a scholarly and exhaustive study of telephone problems from the administrative and economic standpoint such as the telephone industry has seldom received. Although the author confines his field of investigation to the continent of Europe, there are innumerable references to conditions in the United States, so that the American reader need not consider it foreign or inapropos to native problems. In fact, the author undertook his investigations in the hope that a knowledge of European experience with telephones might aid in the solution of the public problem which American communities must face. The book was not written to prove that any one mode of conducting the telephone business is the best; the author simply tried to set forth without prejudice the results of European experience in the conduct of the business. This avowed neutrality, however, has not prevented the author from drawing many interesting conclusions. He seems to believe, or at least leads the reader to believe, that public ownership is the ideal form of telephone administration.

Surveying the various countries of Europe, among which almost very possible mode of telephone administration is, or has been, in operation—free competition, private monoply, public monoply, competition between a state system and a private system, etc.—the author finds the most efficient service existing in Germany and Switzerland, in both of which the systems are publicly owned and administrated. In France, however, public ownership has been a conspicuous failure. In accounting for this discrepancy the author presents a fascinating argument which we think worth quoting:

> The explanation of these contradictory results in neighboring countries is twofold. It lies partly in the different temperaments of the various peoples and partly in the different circumstances under which public authorities in the various countries have been called on to conduct the telephone business. Walter Bagehot, in one of his political essays, has remarked that the men of Massachusetts could work any constitution. The men of Massachusetts themselves would scarcely claim such generous praise as their due, but all will agree that there is a measure of truth underlying Bagehot's statement. Some people possess to a greater degree than others the capacity for collective action. An excellent illustration of this dictum is furnished by the leading Teutonic and Romance peoples, the Germans and the French. The Germans are unquestionably endowed with a greater power of co-operation in the pursuit of common ends than are the French. The stranger who has been among the two peoples, even for a short time, cannot fail to observe the difference in their attitudes toward the conduct of public affairs. The German possesses an instinct of order and discipline which the Frenchman lacks. In his relation towards the public power, the former displays a respect for established authority, and habitually regards it as one of the most indispensable agents in the promotion of the general welfare. The Frenchman, on the other hand, is distrustful of the effects of governmental action, and has a greater regard for personal liberty when it conflicts with the impersonal interest of the community. The civil service is held in greater esteem in Germany than in France; the public official is regarded less as a necessary evil and more as a useful collaborator with the private citizen in his task of gaining a livelihood. The civil service in Germany offers an attractive career to men of high ability. In France such men prefer the freedom of private life. The Germans are thus able to maintain a higher standard of ability in their public administration, and the private citizen who is called upon to assist in the work of public business management takes more pride in performing his part conscientiously and well.

Whether the United States is the kind of a nation that could make a success of public ownership, the author does not state. Our low ideal of public service, as evinced by our toleration of officials admittedly corrupt, and our half-contempt for civil servants as a class, would not appear to be favorable signs. The equivocal status of the postal service scarcely offers any argument *pro* or *con*. It is greatly to be doubted if any system of telephone administration in the United States would have left such a remarkable record of achievement behind it as the competitive system has done. Dr. Holcombe's investigation of European conditions, however, leads him to conclude that competition is not the solution of telephone problems. To quote his own words:

> In the telephone business competition is a failure. Considered as an automatic arrangement for maintaining an accurate adjustment of the supply of telephone facilities to the demand, it easily gets out of order. So long as it remains in order its effect is to diminish the utility of the service to render which telephone facilities are created. For a while it is capable of bringing about low rates and stimulating a rapid development. Sooner or later, however, the self-interest of the competitors or the disillusionment of the public authorities will cause the termination of competition and the substitution of a regime of monopoly. This has been the result everywhere in Europe where competition has once existed, except in Stockholm, and in Stockholm the bankruptcy of a private company or the purchase of its business by the government is only a matter of time. Competition as a permanent status in the telephone business is neither desirable nor possible.

In the final paragraphs of the book the author gives a masterly summing up of the entire problem. He says:

> The great advantage of the ownership of business undertakings by the community lies in the power that goes with possession. While the ownership of business of general public importance remains in private hands, there is no protection for the ordinary economic interests of consumers except by free competition or by public regulation. In the telephone business, the former is neither desirable nor possible. The latter may be obtained in only two ways: (1) by special contract between the private owners and the public authorities; (2) by direct legislative action, subject to appeal to the courts for the protection of individual rights. Under either methods of public regulation, the antagonism of interest between the private monopolist and the consumer may be subdued but is never removed. It was in order to possess complete control over the management of the telephone business that the governments of Europe adopted the policy of public ownership. By retaining complete control in their own hands, these governments have had the opportunity to adopt methods for the establishment of rates and the maintenance of service that would have been impossible under any form of private ownership. In a business such as the telephone, the best security for the establishment of reasonable rates is to give those who are to pay the rates a

voice in their making, and the best security for the accurate adjustment of the supply of telephone facilities to the demand is to give to those who are to use the facilities a share of the responsibility for their creation. Regarding public ownership from the standpoint of production, the extent to which the communities that have taken the direction of their telephone service into their own hands have profited by their venture has depended largely upon the skill with which they have organized their business administration.

Experience has shown that not all peoples possess the capacity for such organization in the same degree. Nor could the same people create an equally efficient public business organization in all industries. In fact the telephone industry has offered peculiar advantages for the experiment of dispensing with the services of the private business man. The effectiveness of public business organization in the telephone industry has been largely dependent upon the peculiar nature of the industry and the extent of the market. The telephone industry can only attain its highest utility when managed as an exclusive monopoly in a given territory. The market for telephone service comprises the whole body of individuals in the territory covered by a connected telephone system, and in practice can be limited for administrative purposes without great inconvenience by the political boundaries of a country. Hence when owned by the government, owner and consumer are identical. Furthermore, the mechanical nature of the service and the stability of the demand for the service make possible accurate prediction of the demand by statistical methods. In those industries in which these conditions are given the policy of public ownership is best fitted to enable the community to avoid both the periodical overproduction of free competition and the perpetual underproduction of private monopoly.

The essence of the transition from private to public ownership is the replacement of the business man (or business corporation) by the organized self-directing community. The effect is the transfer of the risks of the undertaking from private promoters to the community as a whole. In practice this risk is shifted by the community political capacity of producer to its individual members in their economic capacity of consumers. The result is a less rapid introduction of technical improvements than under a regime of free competition, but a more economical dispensation of the public resources. Under public ownership the consumer saves the reward for risk which under private ownership he would have to pay in the form of higher rates. This saving is the apparent recompense for the slower rate of industrial progress. But once it is recognized that in a particular industry the hypothetical alternative of free competition is an illusion, it becomes evident that the community's saving by the assumption of the risks of the enterprise is not a mere recompense for the sacrifice of a more rapid rate of industrial progress, but a clear gain. For under the actual alternative to public ownership in such an industry, namely a regulated private monopoly, there is no greater security, for sound industrial progress than under public ownership, and it is certain that at least a portion of the advantages of industrial progress will be appropriated by the monopolist, solely by virtue of the fact that he is a monopolist. The great merit of public ownership, therefore, as an agent of the production, is that under the proper industrial conditions it fulfills more economically than any other method of industrial organization, the direct purpose of production—that is, the supply of the consumer with the kind and quantity of goods that he desires.

It will be seen that Dr. Holcombe's book is more than a treatise on an economic problem; its roots strike deep into the underlying social forces which control commerce and industry. It is a very vital book, which will be read by students of the economic and social aspects of public utilities, no matter whether the reader has any particular interest in the telephone business or not. As for the practical telephone man, a perusal of the book is bound to extend the circumference of his knowledge and appreciation of the larger telephone problems. With so many rumors of a change of telephone administrative policy in the United States flying about at the present time, it behooves telephone men to possess the kind of information conveyed in this book in order that they may look at new problems from a viewpoint of sufficiently wide range.

GOVERNOR ALDRICH'S VETO.

PRESIDENT VAIL of the A. T. & T., in his annual report, commends commission supervision of telephone utilities. Therefore, during a night session, the Nebraska legislature passed a remarkable and drastic law, forcing the Bell Company to connect with every independent company in the state, permitting the use of its local and long distance lines, with the state railway commission fixing the rates; placing all rates and all service under the binding orders of the commission, with no appeal; permitting the merging of telephone companies only with the consent of the commission, and making it obligatory upon any company securing a controlling interest in another company that the first company purchase two-thirds of the other's stock and hold itself in readiness to purchase the remaining one-third at the same rate.

It also gave the commission the power to deny any proposed company the right to enter a field already occupied by one company or combine should it see fit to do so.

This bill, known as the Minor bill, after much discussion, was amended and passed the house with the merger clause eliminated. When it came before the standing committee of the senate it was reported out, placed on the general file, later to the sifting file and hurried over to third reading, it is said, without a thorough examination being made of its contents. On the way, however, the famous merger clause had been inserted by some means or other, though just how those who voted for it in the upper house were unable to say. When it was returned to the house the senate amendments were concurred in after a fight which was decidedly less acute than when the bill was first up in the house committee of the whole.

Governor Aldrich of Nebraska has vetoed the Minor bill. In his message he gives the following reasons for his action:

I am vetoing House Roll No. 537, generally known as the telephone merger bill, because it contains the following objections.

First—It seeks to control and monopolize telephones and telephone business in existence under one management.

Second—It would prohibit the organizing and operating of new companies any place in the state where any other company was in existence and doing business.

Third—It abrogates existing franchises, which is contrary to the fundamental law of our land, and such an act is clearly retroactive because it impairs vested rights acquired under existing laws.

Fourth—It jeopardizes the rights of the minority stockholders of the selling companies and puts them at the mercy of the purchasing corporation.

Fifth—It permits a merger of two or more competing companies and then requires them, after this is done, to go before the commission and get its permission without, in the first instance, getting the right of the commission to merge.

Sixth—It does not delegate to the commission, authority to prevent such a merger contract, for what is the difference after the merger has been entered into whether they have the permission of the commission or not when the commission has no right to prevent the merger?

Seventh—The provision for physical connection in Section 4 is permissive only, and compulsory in no sense because it requires the consent of the owners as well as the approval of the railway commission.

Eighth—The first three sections of said act are essentially a copy taken from different places in the railway commission law and make no new provision whatever.

So then, this much of said act is surplusage and in fact it may be said that there is no new provision in this set that squarely protects the rights of the public that has not already been provided for in the railway commission law.

The Governor saw in the provisions of the bill a tendency to aid the formation of a gigantic wire trust, to control all the means for the transmission of intelligence in this country. He considers that the independents have done much for the development of the state of Nebraska, and he believes in competition. Furthermore, he cannot see that the merger of all competing and parallel systems would solve any of the problems of service.

The bill was fostered by many independent telephone companies. Whatever their motives, and whether the Governor's views of the situation are justified or not, its provisions were, without question, illy-considered and drastic, and its veto well deserved.

POINTS IN SUGGESTED UTILITY BILL.

AS mentioned in our last issue, the directors of the National Independent Telephone Association have caused to be prepared a bill for general adoption in those states which at present have no commission for the regulation of public utilities. The bill was drawn by Messrs. Savage, Goddard, Valentine and Hunter, in consultation with William D. Kerr.

The usual provisions of a bill of this kind are, of course, embodied in the measure, and need not be commented on. A few of the provisions, however are peculiarly interesting because they deal either with new conditions in telephone practice, or because they throw upon the proposed commissions the burden of deciding points which have always been somewhat obscure to many operators. Of the former class is the provision for physical connection, which appears under Part I, Section 6:

INTERCHANGE OF FACILITIES: (1). Whenever the convenience of the public requires, every public utility is required to interchange facilities with every other public utility of the same kind, provided such interchange is physically practicable.

(2). Every telephone utility, subject to the provisions of this act, is required to connect its lines with the lines of any other telephone utility so situated as to make such connection practicable, whenever the convenience of the public requires such connection to be made; provided, however, that such connections shall be governed by the provisions contained elsewhere in this act.

This is under "Duties of a Public Utility." The corresponding provision under "Duties and Powers of Commission," Part IV, Section 69, is:

PHYSICAL CONNECTION. (1) Any connection of the lines of any two companies which the welfare of the telephone-using public requires may be ordered by the commission in such manner and within such time as it may prescribe, and it shall be the duty of the companies concerned to make connections in accordance with said order, provided that no connection shall be ordered or compelled whereby one line or circuit is to be bridged upon another line or circuit unless by the consent of both owners.

(2) The companies so connecting shall give service over the connecting line or lines without preference to or discrimination against any service whatsoever, and they shall be entitled to make a fair and reasonable charge for every service furnished by them respectively over such connection or in connection therewith.

Returning to Part I, Section 11, we find, as bearing on connection with other lines:

PUBLICITY OF JOINT RATES. Where any public utility holds itself out to participate with any other public utility in the performance of any service, such public utility shall file with the commission the schedule of joint rates or charges that is or may be in force between such two or more public utilities; provided, however, that in the case of an exchange telephone utility which undertakes to receive and deliver long distance telephone messages as a terminal of one or more toll telephone utilities, such exchange telephone utility is required to file only the names of the toll telephone utility or utilities with which it has connections.

"No duplication of existing plants" sounds rather ominous at first blush, from an independent viewpoint. It is not so bad, however, as the title would indicate, as shown by a careful reading of Section 23, Part I:

NO DUPLICATION OF EXISTING PLANTS. No license, permit, right, or franchise that may have been or may be granted to any public utility to construct, equip, own, operate, manage or control any plant or equipment for the furnishing of any public service of the kind which it professes and is organized to furnish in or between any municipality or municipalities where there is in operation another public utility first obtains the furnishing of the same kind of public utility first obtains from the commission, after public hearing, a certificate of public convenience and necessity, declaring that the exercise of such license, permit, right or franchise in the manner intended and proposed by such public utility is necessary and proper for the public convenience.

Part II starts off with the promise that makes the commission form of regulation so attractive to the smaller companies:

REASONABLE COMPENSATION FOR SERVICES. 27 Every public utility is entitled to receive and demand reasonable compensation for each and every public service rendered or to be rendered by it, whether the beneficiary of such service be an individual, a public or private corporation, or another utility with which it interchanges service and facilities. Reasonable compensation is that compensation necessary to enable the public utility, in so far as the circumstances permit, to pay the current costs of operation and maintenance, taxes, deferred maintenance or depreciation, to provide necessary reserves and to afford a reasonable return on the value of the property employed in the undertaking, used and useful for the convenience of the public.

Interesting to the many companies, small and large, which have never found the key to a depreciation account or to clarify its mystery, is the following, Part I, Section 20:

DEPRECIATION ACCOUNTS REQUIRED. Every public utility shall carry a proper and adequate depreciation account. The commission may, in its discretion, prescribe the extent to which such amount shall be carried.

And Part IV, Section 55:

DEPRECIATION ACCOUNTS AND FUNDS; USE THEREOF. (1) The commission shall ascertain and determine what are the proper and adequate rates of depreciation of the several classes of property of each public utility. The rates shall be such as will provide the amounts required over and above the expense of maintenance to keep such property in a state of efficiency corresponding to the progress of the industry. The commission may make changes in such rates of depreciation from time to time as it may find to be necessary.

(2) The commission shall prescribe rules, regulations, and forms of accounts regarding such depreciation, which every public utility is required to carry into effect.

(3) The commission shall provide for such depreciation in fixing the rates, tolls and charges to be paid by the public.

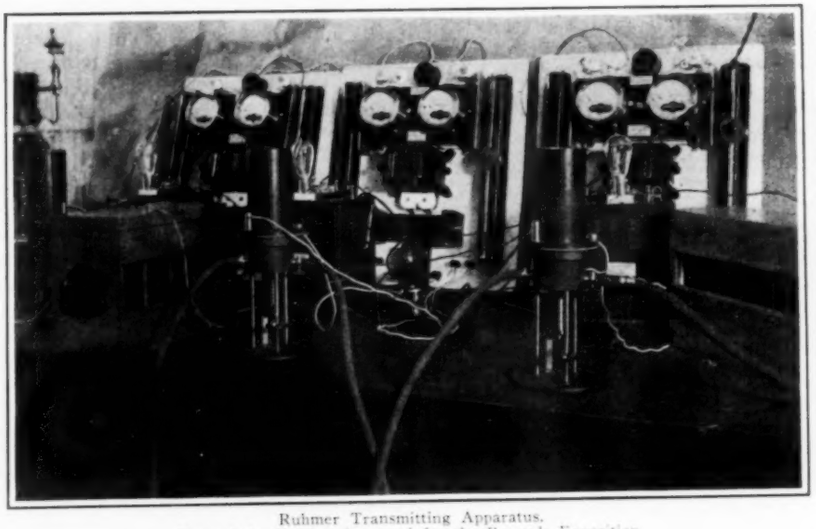
(4) All moneys thus provided for shall be set aside out of the earnings and carried in a depreciation fund. The moneys in this fund may be expended in new construction, extensions or additions to the property of such public utility, or invested, and if invested, the income from the investments shall also be carried in the depreciation fund. This fund and the proceeds thereof shall be used for no other purpose than as provided in this section for depreciation.

Altogether the suggested bill, as published by the National Association, fills a book of twenty pages, and contains about 13,000 words. Space forbids our publishing all of it, but doubtless the association will furnish those interested with copies.

Ruhmer's System of Multiplex Telephony

By C. K. Larson

GREAT minds work in similar channels, the old saying, has it. So it is hardly surprising to find that since the announcement of Major George Owen Squier that the problem of multiple telephony had been solved a number of other investigators have come forward with apparatus designed to accomplish the same ends.

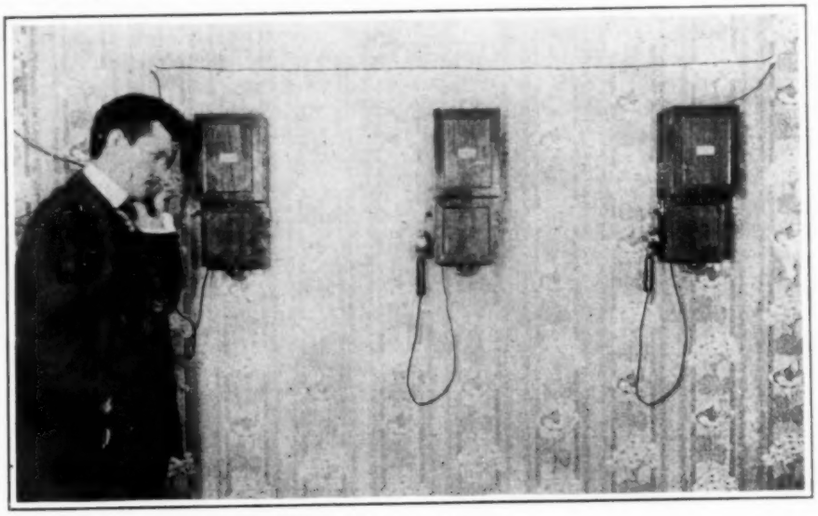


Ruhmer Transmitting Apparatus.
Part of the Display Arranged for the Brussels Exposition.

In Chicago Frank L. Perry, an amateur experimenter of some renown, proved that he had accomplished the duplexing of a telephone circuit more than two years ago. In Mr. Perry's experimental system he succeeded in transmitting, at the same time and over the same circuit, one ordinary two-way telephone conversation and one one-way telephone message without interference. The Perry system depends practically upon the same principle as that used by Major Squier in his multiplex system and described fully in TELEPHONE ENGINEER for February, 1911.

A French patent dated September 16, 1910, shows that Ernst Ruhmer, a prominent scientist of Berlin, has been working along the same lines. He has developed and patented a system of multiplex telephony closely resembling that of Major Squier.

The French patent describes the Ruhmer system very clearly, and our description is derived from that source. The invention relates to a method of transmitting several telephone messages simultaneously over the same wire. These messages depend for the selection of their transmitting and receiving apparatus upon the use of alternating currents whose frequencies are analogous to those employed in wireless telephone work, their vibrations being above audibility and differing from each other sufficiently to avoid interdisturbance.



Ruhmer Receiving Apparatus.

These currents are superposed on the line wire and are separated at the receiving station, where each current acts upon a special receiving apparatus, through the agency of an oscillatory circuit attuned to the pitch of the oscillatory circuit which produces that current at the transmitting station. In this system the different receiving circuits are inductively connected with each other and the line in a comparatively loose or weak manner, in order to obtain a perfect separation of the messages and to assure the proper reception of the feeblest of them, thus preventing confusion in the case of simultaneous transmission of a large number of messages.

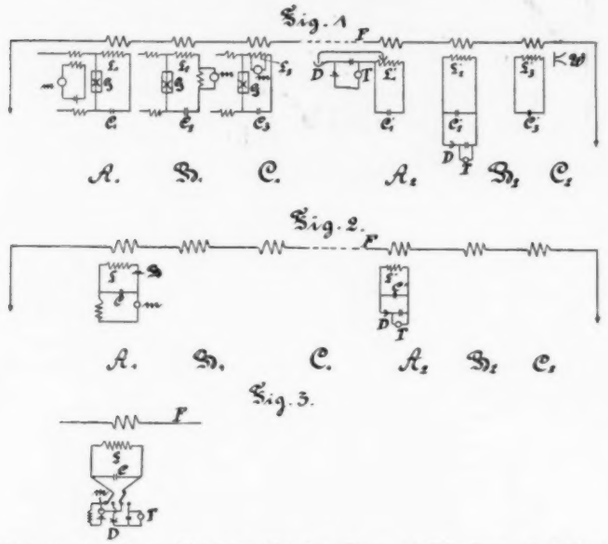
Three modifications of the system are shown in the diagrams. In Fig. 1, three synchronized pairs of transmitting and receiving apparatus are denoted by $A_1 A_2$, $B_1 B_2$, $C_1 C_2$. The high frequency current is produced by a generator of known type, for example, an electric arc G connected in parallel with an oscillatory circuit $C L$, the frequency being regulated by the values of the capacity C and the inductance L. The intensity of high frequency current is affected by the microphone m, which may be bridged across the terminals of the inductance coil L (as in the third apparatus C), or of an auxiliary coil in the oscillatory circuit (as in B_1), or may act inductively on the feed circuit (as in A_1). In general, any method which prevents each microphone from affecting any transmitting circuit except its own may be employed.

At the receiving station each high frequency current produces resonance in a synchronized circuit $C' L'$, and thus acts upon the telephone receiver T by

means of the detector D, as in wireless telephony. Two arrangements of the detector, telephone and oscillatory circuit, are shown in A_2 and B_2, but the detector may be omitted and the messages received directly by a Foucault current W, as in C_2.

Fig. 2 shows a simplified apparatus which does not include any special device for producing high frequency currents. Speaking into the microphone m generates in the oscillatory circuit, composed of the capacity C and the inductance L, trains of damped vibrations having a frequency equal to the pitch of the voice.

Fig. 3 shows an apparatus which can be used alternately for transmitting and receiving messages. The same oscillatory circuit is used for both purposes and is connected, by means of a commutator, with the microphone m and the battery, or with the detector D and telephone T, as desired. The commutator may be so constructed that it also modifies the inductive connection of



Figs. 1, 2 and 3. Diagrams Showing Three Modifications of Ruhmer

the inductance L with the line F, making the connection closer or stronger for transmission and looser or weaker for reception.

The photographs illustrate a set of transmitting and receiving apparatus which was sent to the Brussels Exhibition last year, but was not exhibited because of the fire which so greatly injured the exhibition. In this apparatus the electric oscillations are generated by Poulsen arcs. Only three pairs of instruments were employed because the apparatus was designed merely for demonstration. The instruments worked well, without interfering with each other. Herr Ruhmer writes that he has used his apparatus with success on ordinary telephone circuits with wire return. He adds that the first idea of multiplex telephony occurred to him early in 1907, and is mentioned in his book on wireless telephony, published in that year. The first demonstration of his system was made in November, 1908. He applied for the French patent on April 5th, 1910, and for the Belgium patent still earlier, on March 16th, 1910.

The Middlepoint Telephone Company, Middlepoint, Ohio, recently advertised for "sealed bids for a suitable lineman to do the line work and keep the switchboard in repair."

To Amend Wisconsin Bill

A substitute amendment to bill 886A, providing for physical connection between two telephone companies operating under the public utility law in the state of Wisconsin is presented by the assembly committee on express, telegraph and telephone.

The substitute provides that such physical connection shall be made between two lines operating under the public utility law whenever public convenience and necessity requires and when it will not result in irreparable injury to the owners or other users of the facilities of such public utilities, nor in any substantial detriment to the service. It is stated that "physical connection" means such number of trunk lines as are necessary to furnish "reasonably adequate service." The section, it is provided, shall not be construed to mean that physical connection shall be made between two competing lines in any city.

In case no agreement can be reached between two public utilities as to compensation, application shall be made to the railway rate commission, which shall investigate and issue an order prescribing the conditions and compensation for such service, the expense to be paid by the petitioning utility.

It is further provided that whenever two or more public utilities which are engaged in furnishing joint telephone service to the public shall be required to furnish physical connection and fail to establish joint tolls, the commission may, after notice and a public hearing, fix such joint tolls.

The object of the substitute is to fit the proposed law into the public utility law so as to interfere as little as possible with the law as it stands. It is understood that the substitute has the approval of the railway commission.

Nebraska Minor Bill Vetoed

Governor Aldrich of Nebraska has announced that he has vetoed the Minor telephone merger bill, one of the most important measures upon which a state executive has been called to act for some time. The bill has been under consideration for several days and the action comes as a result of much deliberation by the governor.

The course of the Minor bill has been an unusual one since its introduction in the house. There, after much discussion, it was amended and passed with the merger clause eliminated. When it came before the standing committee of the senate it was reported out, placed on the general file, later to the sifting file and hurried over to third reading, it is said, without a thorough examination being made of its contents. On the way, however, the famous merger clause had been inserted by Bartos of Saline. When it was returned to the house the senate amendments were concurred in after a fight which was decidedly less acute than when the bill was first up in the house committee of the whole.

The Minor bill provided for physical connection of telephone companies when demanded by the patrons of either of two exchanges in a town and permits the purchase or consolidation of telephone companies with the approval of the state railway commission, and also provided that where there is now an exchange no new franchise shall be granted to another company except by approval of the railway commission after a public hearing.

New Automatic Telephone Equipment

By Charles S. Winston*

AUTOMATIC schemes for establishing connections between telephones were devised early in the history of the telephone movement and many of the first patents, which were issued for telephone inventions, were for devices which are the forefathers of the automatic equipment in use today.

During the first 25 years of telephony's history, a few automatic switchboards were installed, but it was not until the installation of the exchange at Grand Rapids, in 1903 that automatic apparatus received very serious consideration from the general public or from engineers, with the exception of a few who were, in most cases, personally interested in its advancement. During the last eight years interest in the automatic method has increased, many articles in regard to it have been written, and now a casual mention of the subject in almost any gathering of men in the telephone business is enough to cause heated discussion in regard to the relative advantages of manual and automatic. Recently new foes, near relatives, of automatic have appeared upon the horizon, which seem destined to play very important parts in the history of the telephony of the future—the automatic-distributing and semi-automatic systems.

In order to prevent misunderstanding, it may be well to state that throughout this paper a switchboard which requires automatic calling devices or dials at the subscribers' station and no operators at the central office will be referred to as an automatic switchboard. An automatic distributing switchboard will be one in which automatic switches are used for distributing calls to idle positions where operators establish connections by means of plugs and multiple jacks, as in the well known manual multiple switchboard, and a switchboard in which the connections between lines are made by means of automatic switches, which are operated by devices manipulated by operators, will be referred to as a semi-automatic switchboard.

The work of designing, perfecting and manufacturing an entirely new line of automatic equipment requires an immense amount of study and experiment. For sometimes the company with which the writer is associated has been developing apparatus which will enable it to manufacture automatic equipment which will meet all of the requirements of automatic, automatic-distributing and semi-automatic. In this article a description will be given of parts of this apparatus which it is not expected to use in practice, but which may be of interest from an historical standpoint, as well as of apparatus which with certain changes will, in all probability, be put to practical use in the near future.

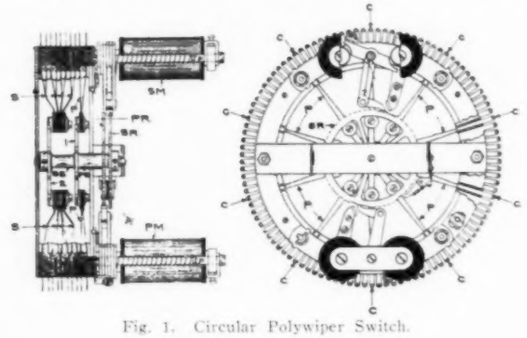


Fig. 1. Circular Polywiper Switch.

Different types of switches are not required for each of these branches of automatic, as the switches which are suited for one can, with slight modifications, be used equally well for the others.

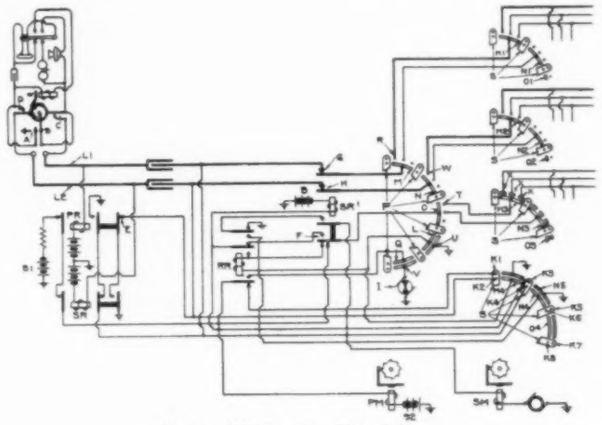


Fig. 2. Wiring of a First Selector.

Up to the present time, the "Strowger" switch is the only one which has been used to any extent. When used as a selector, the wipers of this switch, which are attached to the shaft, move vertically in response to current impulses caused by the operation of the subscriber's dial, and then rotate horizontally until idle trunk contacts are reached. The switches of the five following types will do the same work as that done by this switch, but in a radically different manner. For the lack of more satisfactory names, the switches will be referred to as:

1. Circular polywiper.
2. Circular long and short step with one driving magnet.
3. Circular long and short step with two driving magnets.
4. Double rotary with back release.
5. Double rotary with forward release.

1. CIRCULAR POLYWIPER SWITCH.

Fig. 1 shows a plan view of the circular polywiper switch and a side elevation with certain parts in section. For all practical purposes it consists of two separate switches, each with a distinct driving magnet, wipers and bank contacts, which are built together in one structure to economize space and to facilitate wiring.

Instead of following the usual practice of attaching flexible cords to the wipers and thus continuing the circuit to the desired contacts of the bank, wires are carried to circular metal strips immediately below but insulated from the rows of individual contacts.

*Abstract of a paper presented at the Pacific Coast meeting of the A. I. E. E., Los Angeles, Cal., April 25-28, 1911.

The wipers serve to bridge together the individual contacts and these circular strips. In this manner all cord troubles are eliminated, although there are two movable contacts in each connection instead of one.

The bank consists of five circular rows of contacts, each row being divided into ten equal groups. There are two sets of wipers—the primary *P* and the secondary *S*. The former consists of ten separate single wipers which are mounted upon 36-deg. centers on the plate 1, which is rigidly secured to the shaft *P S*, while the secondary wipers consists of 10 sets

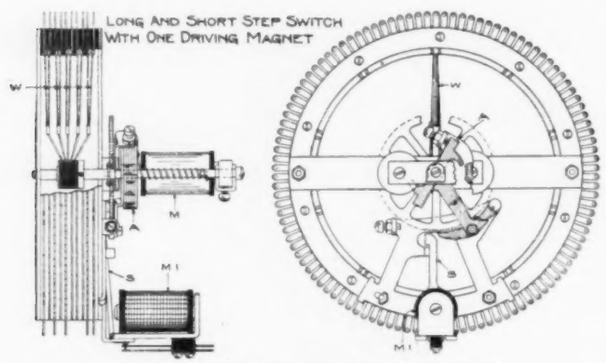


Fig. 3. Circular Long and Short Step Switch.

of four wipers each, mounted similarly upon plate 2, which in turn is fastened to the shaft *S S*. The two shafts *P S* and *S S* and attached to ratchet wheels *P R* and *S R* respectively and through them the primary wipers are controlled by the magnet *P M* while magnet *S M* controls the secondary wipers.

When in normal position, the primary wipers *P* rest upon contacts *C* and the secondary, wipers *S* upon the contacts in line with and below contacts *C*, while these connections will be broken when the wipers are moved forward by the operation of the driving magnets. When the wipers have moved 11 steps the same condition will again be met and the switch will again be in normal position.

In Fig. 2 is shown the wiring of a first selector, individual to a line, using a switch of this type, with the wiring of a subscriber's telephone including a calling device. When the switch is normal the 10 primary wipers will be in the positions shown at *P*, while *S* represents the positions of the various secondary wipers. The common strips *M, N, O, M1, M2, M3*, etc, are each associated with 10 contacts instead of three as shown. The system illustrated uses a single source of current for both signalling and talking, while a ground return circuit is used for operating the relays which in turn operate the magnets which move the switch wipers.

In order to assist in giving an understanding of this switch, the method of operation of the circuit shown will be described briefly.

A subscriber desiring to converse with a second subscriber will remove his receiver from its hook, thus establishing a path for current through relays *P R* and *S R* and the appaatus in his instrument. He will then operate the calling device, thus connecting springs *A* and *B* to ground and breaking contact *c* a definite number of times, while current flowing from ground over line conductor *L2* will maintain relay *S R* in the energized position. Each time the circuit is broken in this manner, relay *P R* will be de-energized and contact *E* closed, thus sending current through the primary magnet *P M*, and causing the primary wipers of the switch to make a certain number of steps. (Secondary contacts *K1* and *K2*, *K3* and *K4*, *K5* and *K6*, *K7* and *K8* are connected together through wipers whenever the switch is in the normal position.) Immediately thereafter and just before the calling dial returns to normal, both line wires remaining grounded, contact *D* will be broken once, thus holding relay *P R* energized and causing one de-energization of relay *S R*. For the purpose of illustration, suppose that the subscriber desires conversation with a second subscriber whose number begins with one. The primary magnet would then take one step, establishing connections between *M, N, O, L* and *Q*, and *R, W, T, U* and *V* respectively. Immediately thereafter, the de-energization of relay *S R* as above explained, will cause the energization of relay *S R'*. It will be noticed that the energization of the latter relay will establish a circuit from the negative pole of battery *B*, through the winding of this relay, back contact of relay *R R*, through the normally open contact *F* of relay *S R'* to the contact plate 0, through the wiper to contact *T*, and thence to common plate *M3* of the secondary contacts. The energization of relay *S R'* will also close a path from the alternating-current generator *G* through the secondary magnet *S M*, thus moving forward the secondary set of wipers *S*. If the private contact *x* is busy, due to a ground on the corresponding contact of some other switch, relay *S R'* will remain energized and the switch wipers will be stepped ahead until a contact is found which is clear, when relay *S R'* will be de-energized and the switch will come to rest. The de-energization of relay *S R'* will close the talking circuit from the subscriber's instrument, through contacts *G* and *H*, and the primary wipers and contacts, to the secondary wipers and thence to a second selector.

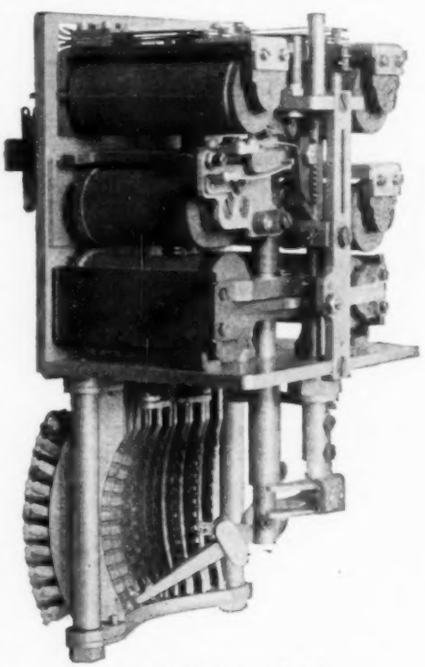


Fig. 4. Double Rotary Switch.

When the subscriber returns his receiver to its hook, relays *P R* and *S R* will be de-energized, thus causing relay *R R* to be energized by current flowing from ground at switch contact *U* to the negative pole of battery *B1* and locking relay *R R* through *S R'* to battery *B*, thus cutting off the circuit from battery *B1*. The energization of the later relay will again establish a circuit through the secondary magnet *S M* to ground at *N5*, while the energization of relay *R R* will cause

current to flow from battery *B2* through the winding of the primary magnet *P M*, a primary wiper and contact *V* to ground, through the interrupter *I*. The energization of these two magnets will be continued till the wipers have been driven ahead until they rest at *P* and *S* upon the normal contacts between the groups, at which time the circuits for all relays will be opened and all apparatus will be in normal position.

In the circuit shown, but five of the ten primary groups of contacts are used. It will, therefore, be seen that a large number of contacts are available for use as "off normal" contacts if the circuit requirements make it desirable. This feature of the switch is one of its chief advantages, but the difficulties which are necessarily met with in assembling and in wiring make it impracticable from the standpoint of manufacture and operation.

2. CIRCULAR LONG AND SHORT STEP SWITCH WITH ONE DRIVING MAGNET.

As shown in Fig. 3, the construction of the long and short step single driving magnet switch is similar in general appearance to the polywiper switch, there being 10 circular groups of 10 contacts each. However, there is but a single set of wipers, which when moved forward by the driving magnet *M*, the magnet *M'* being de-energized, passes over one group of ten contacts at each step. If, however, magnet *M'* is energized at the time when the wipers are being stepped forward, the movement of armature *A* will be shortened by the stop *S* and the wipers will move from one set of contacts to the adjacent contacts for each energization of magnet *M*. As will be seen from this statement, each one of the 10 circular sets of contacts corresponds to a row of contacts on a vertical and rotary switch. That is, in this switch the wipers instead of moving a certain number of steps in one direction and then rotating at right angles, move a certain number of long steps and then take short steps until they arrive at contacts of a trunk line which is not in use, in the case of a selector, or until the contacts of the desired line are reached, in the case of a connector.

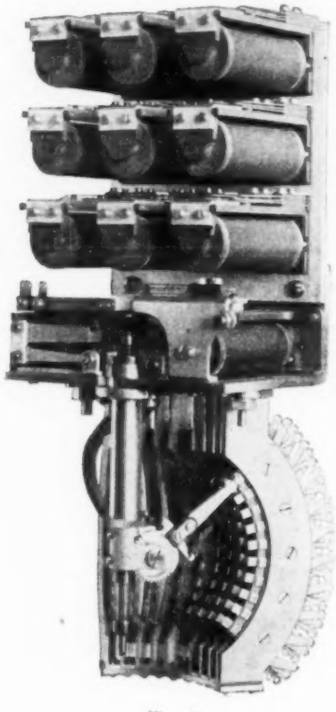


Fig. 5.

3. CIRCULAR LONG AND SHORT STEP SWITCH WITH TWO DRIVING MAGNETS.

This switch is very similar to the one just described. The only difference of importance is that instead of using a magnet to limit the stroke and hence to move the wipers from one contact to the next, two separate magnets are employed, one for giving the long steps and one for giving the short.

4. DOUBLE ROTARY SWITCH WITH BACK RELEASE.

It will be seen upon referring to Fig. 4, which shows this switch as a first selector, that the contacts are mounted in 10 separate strips or groups, each of which has 10 sets of contacts (each set consisting of two line contacts and one private contact) arranged in an arc circle, so that when completely assembled, all contacts point inwardly toward a common center.

Instead of using a single shaft, with the wipers rigidly attached, which moves vertically to select a group of contacts and then revolves horizontally to select the trunk, two shafts are used in this switch. One, to which the wiper frame is directly connected, rotates, in a horizontal plane to select the group. The second is so connected to this frame that its downward movement gives the wipers a second rotary movement, thus stepping them upward into engagement with the bank contacts. Primary and secondary magnets are used for accomplishing these results, and the switch is returned to normal by means of a release magnet. Because of the relative arrangement of shafts and wipers, the latter move four or five times as great a distance as the former for each energization of either the primary or secondary driving magnet, and hence the movement of the armatures of these magnets is exceedingly small. It has been found from experiment that, due to this construction, switches of this type operate satisfactorily when the voltage of the storage battery used therewith is as low as 35 and that the height to which the voltage may rise does not affect the operation, as current of any voltage which the relays, used with the switch, can stand without injury may be employed. Hence, it is not necessary to use two sets of batteries—one for discharge while the other is being charged—or to resort to the use of extra storage cells or counter e.m.f. cells to maintain a constant voltage.

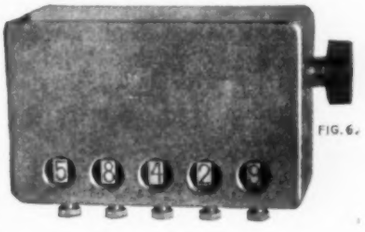


FIG. 6.

Fig. 6. Calling Device.

This switch is constructed so that the switch proper, consisting of relays, wipers and driving magnets, is supported by the frame of the contact bank in such a way that the switch can be removed instantly if trouble occurs without it being necessary to unsolder wires. The contact bank is fastened to the iron framework which supports all switches and hence the multiple wires do not support the bank when a switch is removed.

5. DOUBLE ROTARY SWITCH WITH FORWARD RELEASE.

This switch, which is shown in Fig. 5 as a connector, is similar in many respects to the switch just described. The arrangement of the bank contacts is similar although more space is provided in this switch in order to facilitate the multiple wiring. Primary and secondary magnets give the wipers a double rotary motion but, in releasing, the magnet which has caused the vertical movement is again brought into use and the wipers are driven forward to the end of their vertical stroke. When this position is reached, a projection carried upon the wiper arm releases a

retaining pawl, which has kept the wipers in the position into which they were driven by the primary magnet, thus allowing the wipers to move horizontally due to spring tension. When they have returned in this direction as far as possible, which is to a position directly above their normal position, a second retaining pawl, which after each vertical step has kept the shaft in its vertical position, will be released and the wipers will be returned to normal position.

As the release of this switch is accomplished by driving the wipers forward, clean contacts are at all times assured. In back release selector switches the last contacts in all rows are used infrequently, and hence they become coated with dirt and grease, thus preventing satisfactory connection when it becomes necessary to use them. Another advantage of this type of construction is that the wear on all contacts will be equal and hence the life of the bank increased.

During the last year a life test was made with a switch of this type. The switch was subjected to all the mechanical and circuit changes which it would undergo in practice in operating 1,378,000 times, which is equivalent to the use which an average switch in an exchange of 10,000 lines would receive in 37 years' service. As, however, the wipers continuously passed over the tenth row of contacts, instead of each of the ten an equal number of times, the wear on these contacts was equal to what it would be in 370 years of service.

AUTOMATIC CALLING DEVICES.

Second only in importance to the selector and connector switches, if it is not of equal or even greater importance, is the calling device used at the subscriber's station. The design of a calling device which will meet all conditions of service is an extremely difficult problem. The work to be done requires complicated mechanism which, as it is to be used by unskilled hands, must be strong, positive in operation and "fool-proof." If a switch fails to properly perform its functions an attendant who is always present can remedy the trouble, but trouble in a calling device makes necessary a trip of the troubleman at an expense which may not be small.

It is possible to design calling devices of a great many different types, and numerous patents have been issued for schemes of various kinds. In connection with the automatic development referred to, calling devices of six or seven different types have been made. Some are of the "finger-hole" type, others employ a lever for their operation, while one has been developed in which the subscriber sets up the number of the desired station on the face of the device before sending the impulse. A cut of this device is shown in Fig. 6. Upon referring to this figure it will be seen that there are in the top plate five circular openings through which digits are visible. Extending from the side of the device below these openings are five buttons which when turned either to the right or to the left change the figures from 1 to 0. Therefore, it is possible to set up any number between 00000 and 99999, or in other words to use this device as shown, in a one-hundred thousand line system.

The method of procedure in making a call with this device is as follows: The subscriber removes the receiver from its hook, turns the buttons in the calling device (this can also be done before removing the receiver if desired) until the proper number appears, and turns the lever at the right hand end until a stop is reached. The mechanism within the device will then operate and cause the operation in succession of the selector and connector switches. During the time that the impulses are being sent, the figure-changing buttons, as well as the sending lever, will be locked so that the subscriber cannot interfere with the signaling. (*To be concluded.*)

Equipment at Sidney, Ohio

Last month Charles F. Morris described in these pages the new equipment of the Sidney Telephone Company at Sidney, Ohio. Additional details of the installation have since come to hand, and may be interesting to those who read Mr. Morris' article.

There are ten incoming trunks, seven of which are arranged for connecting local lines with magneto toll or long distance conversations, while the other three are arranged for connecting rural lines with magneto-toll lines for long distance conversations.

The toll cord circuits are arranged with double lamp supervision by means of "ring up" relays. The individual cord circuits are provided with two way ringing, monitoring and listening keys.

In connection with the toll switching trunk circuit a unique type of key is used. This key is of the four-button clutch type, and is so arranged that when the ringing button is once set by the operator it remains set until the subscriber answers, when it automatically assumes its normal unoperating position. This is a novel feature which means a considerable saving in time to the switching operator and a consequent increase in the number of lines which one operator can handle.

The toll equipment consists of one two-position toll switchboard with a capacity of 100 lines. At present it is equipped with twenty outgoing trunks, including ten trunks to subscriber's board for toll switching, trunks to the chief operator, wire chief and manager, and ten incoming trunks. There is also a two-position chief operator's desk equipped for both a chief operator and an information operator. This contains trunks to the manager's desk, wire chief's desk, toll board, subscriber's switchboard, and is provided with monitoring circuits and service observation lines for properly supervising the work of the operators and determining the character and efficiency of the service.

The one-position wire chief's desk of the cordless type is arranged with a set of drawers on either side, together with compartments for trouble tickets. The desk is equipped with a Weston voltmeter, 0-30 scale, and all circuits for the proper testing of lines and trunking to all necessary points.

The manager's cabinet is mounted on the manager's desk. The equipment enables him to supervise all the positions at the subscriber's rural and toll boards, the cabinet being provided with trunks to these positions.

The power plant consists of a motor generator, a storage battery equipment capable of carrying the exchange forty-eight hours without recharging, a four-frequency, multi-cycle ringing machine and the necessary power and battery controlling apparatus.

The equipment described was all manufactured and installed by the Western Electric Company, including distributing frames, lighting equipment, cabling, etc.

Motors in Telephone Exchanges

By C. W. Burkett*

IN modern common battery telephone exchanges both direct and alternating current motors are used very generally. The specific use for motors in such telephone exchanges are as follows:

1. Alternating current motors of both single phase and poly-phase types and constant potential direct current motors are used for driving generators for charging storage batteries, which in turn supply the talking current and current for signaling purposes. These motors will vary in size from about 1½ to 48 horsepower and if direct connected to the generator will vary in speed from approximately 50 to 2,000 revolutions per minute.

In that it is absolutely essential in a telephone exchange to have a reliable source of power, frequently two motor generator sets are provided for charging the main battery; one of these usually being direct current and the other alternating current, if these two sources of power are independent and available. If this is not the case, and if gas is available, one of the generators is usually driven by a gas engine.

2. A small motor in the larger common battery exchanges is usually provided for charging a smaller storage battery which is placed in series with the main storage battery to provide 48-volt current for use on long distance connections. This motor is usually of a capacity from one to five horsepower.

3. Usually two sets of motors, one either alternating or direct current, supplied from the city power current, and the other supplied from the storage battery, are provided for operating the service motor-generators which provide 30-volt direct current for operating service meters, used in connection with the recording of telephone calls. These motors vary in size from one to two horsepower.

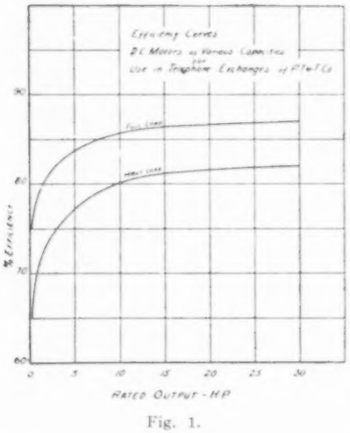


Fig. 1.

4. In the larger exchanges, motors are provided for driving twin generators which supply 110-volt current, both positive and negative, for the operation of coin collectors, or what are usually termed "pay-back nickel machines." These motors will vary in size from one-half to two horsepower in the larger exchanges.

5. Both alternating and direct current motors from independent sources, are provided for operating ringing generators which are used to supply the current for ringing subscribers' stations and ringing on toll and "ring-down" trunk lines. These motors will vary in size from about one-half to one horsepower.

*Paper presented before San Francisco Section A. I. E. E., Feb. 24, 1911.

6. In all of the larger exchanges, motors are provided for driving generators for supplying 65 and 110 volt current for the operation of telegraph instruments used in connection with long distance telephone lines.

7. In many of the modern exchanges a ringing dynamotor is provided instead of a ringing generator in connection with a motor. The machine consists of a double wound armature and a single field, and is practically a rotary converter. Direct current for the operation of the machine is usually obtained from the main storage battery and the alternating current side supplies single-phase alternating current at approximately 75 volts and 16 cycles. These machines are usually two-pole and are operated at 1,000 revolutions per minute. They will vary in size from approximately one-sixth to one horsepower.

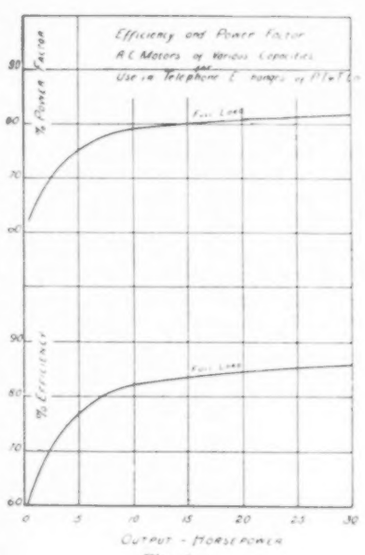


Fig. 2.

8. In the larger multi-office exchanges and particularly where considerable long distance or toll business is transacted, motors are provided for the operation of either a belt conveyor or pneumatic ticket distributing system. This system is used for the distribution of tickets from the recording to the toll line operators. These motors will vary in size from one to approximately twenty horsepower. The largest installation of this sort on the Pacific Coast is in the Kearny office of our San Francisco exchange. In this exchange we have a vacuum conveyor system, which requires approximately twenty horsepower for its operation. Two motors are provided; one alternating and the other direct current. Either one or the other of these motors is in continual service and the other is used for reserve.

In the design of telephone power plants, it is usually found expedient to install motors which are somewhat in excess of the initial requirements. This is done in order that the entire central office equipment may be as nearly in cost equilibrium as possible. For this reason, motors for telephone use are required to conform to quite rigid specifications. Particularly is it necessary that the efficiency curves from approximately one-half to full load be flat as possible. It is also necessary in telephone motors that the speed limits be kept close, as the adjustment of telephone signaling apparatus, in common battery exchanges, is close and also, a difference in transmission will result if any considerable variation in voltage of the current supply be permitted.

For a common battery telephone exchange of 10,000 subscribers, motors aggregating 100 horsepower for both operation and reserve will be required, while an exchange of 1,000 subscribers requires motors less than ten horsepower.

DIRECT CURRENT MOTORS.

The requirements for direct current motors upon which we have usually insisted are as follows:

Efficiency: The minimum efficiency for varying sizes is shown on the attached curve.

Type: The type of motor is, in every case, constant potential.

Heating: The heating requirements are as follows:

The motor should be capable of delivering continuously its rated output at the specified voltage without a rise above a room temperature of twenty-five degrees Centigrade.

Field and armature, by resistance measurement, fifty degrees Centigrade and by thermometer, forty-five degrees Centrigrade.

Commutator and brushes, by thermometer, fifty-five degrees Centigrade.

Bearings and other parts of the machine, by thermometer, forty degrees Centigrade.

Further, the motor should be capable of running for two hours at a twenty-five per cent overload without injury to any of the parts.

Brushes: The motor should be provided with brush holders and carbon brushes of a type which will insure satisfactory operation. The current density in carbon brushes should not exceed 35 amperes per square inch. For motors operating at less than 30 volts, metallic gauze may be used.

Commutation: The motor should run without injurious sparking from no load to 25 per cent overload without alteration of the position of the brushes.

Bearings: The motor should be provided with self-oiling and self-aligning bearings.

Speed: The speed should not vary more than five per cent between no load and full load, when the voltage of the supply mains is kept constant at the normal voltage. Variation of speed, due to a variation of five per cent above or below the normal voltage, should not exceed five per cent above or below normal.

When motors are used in combination with ringing generators, the motor should be capable of driving the generator under all specified conditions of speed and load.

Mounting: Depending upon whether the motor is direct connected to the generator or belt connected. It should, in the first case, be mounted on a rigid sub-base of cast iron or I beam construction, which sub-base should be common to the motor and the generator to which the motor is connected; or, in the second case, the pulley should, of course, be of proper dimensions and width of face for belt driving.

Starting Box: In general the motor should be provided with a fireproof starting box and this box should be equipped with both an over-load and no voltage release. The starting box is usually mounted at the rear of the power switchboard.

Insulation: The insulation between the armature and field windings and between these windings and the frame, and, if direct connected, between the two machines and between the motor and the sub-base should not break down when subjected to the following mean effective differences of potential of alternating electro-motive force continuously applied for one minute:

Rated Terminal Voltage	Capacity of Motor	Testing Voltage
Not over 400 volts	Under 10 kilowatts	1000 volts
Not over 400 volts	10 kw. and over	1500 volts
400 to 800 volts	Under 10 kw.	1500 volts
400 to 800 volts	10 kw. and over	2000 volts

ALTERNATING CURRENT MOTORS.

Type: The motor should be of the self-starting induction type and should operate satisfactorily on an alternating current circuit of the voltage, frequency and number of phases specified.

Heating: The motor should be capable of delivering continuously its rated output at the specified voltage and frequency without exceeding the following rise above a room temperature of twenty-five degrees Centigrade:

Electric circuits, by resistance fifty degrees Centigrade.

Bearings and other parts of the machines, by thermometer, forty degrees Centigrade.

In squirrel cage or short circuited armatures, fifty-five degrees Centigrade, by thermometer, may be allowed.

Starting Torque: The motor should develop sufficient torque to start the machine to which it is connected, the machine being at no load.

Insulation: The insulation between the different circuits and between the primary circuits and the frame, and, if the motor is direct connected, between the two machines and between the motor and the sub-base, should not break down when subjected to the following mean effective difference of potential of alternating electro-motive force continuously applied for one minute:

Rated Terminal Voltage	Capacity of Motor	Testing Voltage
Not over 400 volts	Under 10 kilowatts	1000 volts
Not over 400 volts	10 kw. and over	1500 volts
400 to 800 volts	Under 10 kw.	1500 volts
400 to 800 volts	10 kw. and over	2000 volts

Speed: The variation of speed of the motor between no load and full load should not be more than five per cent when the voltage of the supply mains is kept constant and the frequency is normal. The variation of speed, due to a variation of five per cent in either voltage or frequency of the supply mains, should not exceed five per cent from normal.

Bearings: The motor should be provided with self-oiling and self-aligning bearings.

Mounting and Means of Driving: Depending upon whether the motor is direct connected to the generator or belt connected. It should, in the first case, be mounted on a rigid sub-base of cast iron or I beam construction, which sub-base should be common to the motor and the generator to which the motor is connected; or, in the second case, the pulley should, of course, be of proper dimensions and width of face for belt driving.

Power Factor and Efficiency: The power factor and efficiency of alternating current motors at full load should not be less than is shown in the accompanying curves.

Owners and representatives of twenty-four independent telephone companies recently organized the Mid-State Independent Telephone Association at Geneva, N. Y., for the purpose of advancing independent telephone interests.

What One Woman Thinks

By Sarah Elizabeth Brown

NEWSPAPER clippings! When you began sending me little packets of them, they were magnetic little messengers, and they are all of that all the time. When I decided to conduct this department I was confident that what I had to say would fill the book for about ten years, but after a time I concluded much that I might say would sound like over the back fence gossip between neighbors. Then you sent me some newspaper clippings! What a comfort they are—the irregular, ill-shaped, tabbed cuttings.

The first one is stamped in green ink, "Spokane, Wash. *Review.*" It is dated April 16 and emphatically declares that the telephone business is a good business—good enough for anybody. It starts out by telling of the Home Company at Spokane. How immense it is—how effiicent and how beautiful—representing an investment of nearly a million and a quarter. But the real story is centered around Thaddeus S. Lane. It points out that Spokane is only one of ten systems that Mr. Lane has built in Washington, Idaho and Montana. The best part of it is a picture of Mr. Lane's new home—a massive structure of frame and granite, finished in hardwoods and attractively decorated. The home is something of a mixture of English architecture, but it is certainly an attractive structure from the outside. It is said that Mr. Lane paid $30,000 for it before he started in to fixing it up. All of this reminds me that Thaddeus S. left Buffalo a few years ago to discover some unoccupied telephone territory. He settled in Butte, which he found all the name conveys in its slangy definition. It is also said that there are eighty-four carloads of Home cable buried in the streets of Spokane—a quarter of a million dollars' worth. That the freight cost $60,000! This is only put down here to show that the world moves and that T. S. Lane is moving with it—moving into a magnificent domicile that will contribute blessings to a man who will swear by the telephone as a money maker.

* * *

They have been all mussed up in Nebraska during the month. The trouble followed some ill-advised telephone legislation. The Nebraska legislature carried its session into the night to enact a telephone controlling law which was designed to knock the breath out of monopoly. The law was to enforce inter-connection, regardless. Every independent company must connect with the Bell. The railroad commissioners fixed the rates. No appeal. No mergers without the commissioners' approval. Any company securing stock control of another company must buy the last third at the prevailing rate of the first two-thirds. No rights granted anybody to enter a field already occupied. Believe me, brothers, it was some law, even more drastic than I have hinted might be passed when we weren't looking. Now, I just happen to know something about law-makers, the appointing powers of administrations and the kind of men who sometimes slip into the commissioner body. It would be better to have a hand in matters that affect you and I, for, as I have said on other occasions, I'm in the telephone business myself. I got my new spring hat that way and expect to get my next winter's bonnet from the same source of supply. It is sheer nonsense to slip all the power to a railroad or any other commission. Fortunately, that Nebraska measure fell into the hands of a governor who was thinking for you and me. It is reported that he gave much time to this bill and concluded, as you may already know, by vetoing the measure. I hope you will print his reasons for the veto, because of its influence upon telephone men in general. If Governor Aldrich does nothing more during his term of office, he has claim to being a good, sensible sort of executive.

* * *

I am wondering if you people who follow me recall what I had to say about the Central Union nearly a year ago—last June, to be exact. Now comes the climax. The Bell business for Ohio, Michigan, Indiana, Illinois and Wisconsin will be administered in Chicago. It is given out that B. E. Sunny, in addition to being president of the Chicago Telephone Company, will be president of the Central Union, the Wisconsin and the Michigan telephone companies. L. G. Richardson, the man who made Central Union, becomes the vice-president and general manager; Alonzo Burt, vice-president and treasurer. Messrs. Trafford and Hill, formerly general managers of the Michigan and Central Union, respectively, become vice-presidents. N. C. Kingsbury, former president of the Michigan, is elevated to a vice-presidency of the A. T. & T. Mr. Kingsbury is active in the present negotiations with the independents and is new enough to have some ideas of his own. A. S. Hibbard, general manager of the Chicago Telephone Company for so long the memory of independents wots not, joins the staff of T. N. Vail in New York City. In other words, Chicago becomes a big center for Bell operations. Nothing has been given out regarding the plans of this new administrative force. No hint of merging—no scheme of operation. What is the Bell's business is nobody else's business.

* * *

Bert Hubbell turned the trick down in his state, didn't he? Great little single-handed performer is Bert. He got 'em an injunction! Rochester doesn't go into the Bell scheme as planned. The friendship company is through with it. President Stevens says so himself. Hubbell, acting for the Federal, saw that he would go into a pocket if Rochester, Syracuse and Utica changed the emblem and having some fish of his own to fry he brought action in the Supreme Court. Justice Lambert issued an injunction restraining the Bell company from consummating its purchase. The defendants named included nearly everything and everybody from Boston to Buffalo—telephone companies, trust companies, banks and stockholders. The matter is supposed to rest there. It will be remembered that the Bell was negotiating for 65 per cent of the stock, insisting upon that much or

none. The very latest I have on the subject quotes Mr. Stevens as saying that the deal is off "for the reason that the Rochester people have been unable to secure the deposit of the requisite amount of securities of each class, provided for in the agreement on or before April 15, 1911." Isn't Hubbell the wonder!

* * *

I used to think that the real telephone noise originated in Ohio. Now I'm so befuddled that I haven't a guess. There is something doing every minute and it is progress, progress, progress, all the time. When Obediah got back from the Iowa convention he had me going southeast for fair. I even helped with the milking that night so I wouldn't miss any of his report while he was in the humor to talk. Talk about endorsing Jim Shoemaker—why Jim's ghost presided over the deliberations of the Iowa convention. Even Jim Kelsey got a nip of the Jim Shoemaker platform, drawn two years ago. They'll fuss around in Iowa and put up a bronze in Waterloo's park in honor of Iowa's emancipator if they go much further! The convention swept away the old constitution and by-laws, and now regards any independently owned company as being eligible to membership, disregarding its connections. Think that over, my brothers. No lamb lying for the lion to grab. Just let 'em all in. No secret sessions; no labels; no sergeant-at-arms to keep out the spies! Dear, oh, dear, how we do change our minds. Iowa endorsed commission control with a brief, business-like resolution. It announced to the world it knows its business and would mind it, with one eye on the public and the other on the stockholder's investment. That's the Iowa idea. Ohio papers please copy, as Durgy Simpkins says in some of the death notices of the *Herald*.

* * *

Say, is Charlie Lederer a bird? I see he puts wings on everything. He signs his name with a sketch of a bird. He even puts wings on Honey Papa and makes a Cupid of him. Think of having to pay Lederer for such things!

* * *

There is nothing in New York's law to prevent one corporation buying another. But New York lawyers have a way of stopping that sort of practice. Are you smart enough to figure it out?

* * *

Some of the unsophisticated think the Bell companies are on the verge of bankruptcy; that they can't carry themselves; that the Rochester deal went up in the air because the proposition was taking too much money. That thought goes back to the crowd who are forever discrediting the telephone business. It is my opinion that the Bell companies will have most of the things they want. I do not know why the Rochester deal was blocked—if it was—but I do know that economy of operating has become an infection with our big competitor and that it isn't wanting any more adverse criticism than it can avoid. But that it can finance itself and trim off about everything it wants is my honest belief. When an institution earns three millions a month net; pays nearly two millions a month in dividends; has fourteen or fifteen millions in the cash register; passes $500,000 a month to reserves and surplus; maintains its plant; improves its service; buys little things like the Western Union over night; keeps going—well, I guess it might stand a chance in wagging along a little while, even if there is some barking at its heels.

* * *

There is some talk of merging all the independent lines in Texas under the Mackay banner. I have been across Texas. There is freedom for talk in Texas. When the independents merge their lines down there I will be putting new wires on my harp up yonder. It is a commendable little piece of newspaper enthusiasm which has grown out of the activity at Houston. It is nearly as good as the dope that used to be sent out from Milk street, Boston.

Objections to New Boston Rates

Many faults were found with the new rates of the New England Telephone & Telegraph Company, which were put into effect as a result of the Jackson report to the Massachusetts Highway Commission, at a hearing given by the legislative Committee on Mercantile Affairs at Boston. Six bills which their petitioners evidently hoped would aid in investigating telephone conditions, cost of maintenance and operation, and form a basis for more equitable rates, were under discussion, but nearly every speaker—all opposing the company's plans in one way or another—talked in a general way against the zone system or other features of the new schedules without confining himself to any particular bill.

The bills included those of the United Improvement Association, to postpone the compulsory operation of rates in the Boston and suburban districts, to reduce the rate to five cents for five minutes' talk within the metropolitan district, to transfer the supervision of telephone and telegraph rates from the Highway to the Gas and Electric Light Commission; the petition of Charles A. Dean for a flat rate of five cents for five minutes' talk between Boston and suburbs; the petition of Harvey L. Partridge for a flat rate for unlimited suburban residence service; the petition of Charles M. Conant and others for the appointment by the governor of a commission to investigate telephone systems.

Roosevelt Starts Telephone Exchange Working

April 9 Theodore Roosevelt set in motion the machinery of a Spokane, Wash., million-dollar automatic plant, the Home Telephone and Telegraph Company, when he pressed the ivory button which blew out the fuse which has held dormant 6,000 independent automatic telephones in Spokane.

The delicate touch was given at the close of the banquet program in the Hall of the Doges. Thaddeus S. Lane, president of the company, had run a wire into the hall and was persistent that Spokane's distinguished guest should do the honor of starting the infant industry to working. It was the first similar ceremony in Spokane which started a costly Spokane plan in operation.

Mr. Roosevelt made only a brief talk in opening the system, but in that wished it success in filling the mission that awaited it. E. T. Coman, president of the chamber of commerce, handed the button, attached to a gold and copper wire, to Mr. Roosevelt.

The Telephone Scrap Book

The Investigations of Bruin

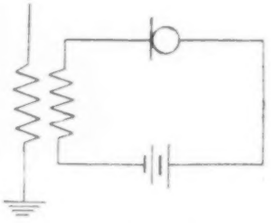
[An article in *Zeitschrift fur Post und Telegraphe* recently stated that "The humming of the wires led the bears to believe that the poles were the headquarters of bees, and they pursued that enticing goal. Their longing for honey gave rise to fresh destruction. But the shaggy dwellers in the forest learned by their disappointment; the number of attacks on lines decreased more and more, and eventually the humming of the wires lost its attractive power for Bruin." The picture thus conjured up induced E. M. Buckland to burst into song. His refrain was presented in the *National Telephone Journal;* while the accompanying photograph is here because of the courtesy of the *Telephone Review.*]

IN the dark Norwegian forests
Snug beneath the pine trees couching
Slept the bear, the honey hunter,
Slept and slumbered through the winter.
O'er his dreams a sound came stealing,
Louder now and now retreating,
Like the humming of the wild bees.
And he dreamt of feasts of honey—
Feasts of wild and luscious honey—
Woke and started from his couching,
Started out to find the humming
Which came faintly on his senses,
Through the pine trees still appealing.
Stiffly moved he through the forest,
Still with sleep his limbs were heavy,
And the snow lay thickly round him,
Blinded was he by his dreaming,
Never once thought of the season,
Never thought that it was early,
Very early for the wild bees.
Lunged and lumbered through the forest,
Till he came where rose a pine tree,
Straight and bare it rose up stiffly,
And it seemed the wild bee humming
From the topmost branch was coming.
So he climbed with pain and groaning,
Often slipping, often moaning,
Gained the top and reached out blindly,
Searching for the magic honey,
But no honey did he find there,
Only china insulators—
Cold white china insulators.
Got all tangled in the wiring,
Slipped and fell and broke the wiring,
Came to earth a sadder Bruin.
Slowly to his couch repairing,
Thought he sadly, thought in this wise,
"Though the humming goes on coming,
"I shall know 'tis only mumming,
"And the bees that make the drumming,
"Bees that sting but make no honey."
And the gang who came to mend it
Murmured sadly "Drat the bear."

Simplified Wireless Telephony

SO little has been heard of late from wireless telephony that it almost seems as if the art were entirely forgotten, or at least that it does not make any progress. It therefore gives the writer pleasure to bring out a few facts which he has observed and which he hopes will be followed up, says M. Freimark in the *Electric World.*

In the spring of 1910, while making experiments to devise a method for locating open circuits in insulated and concealed wiring, it was found that the human body acts as an excellent antenna and detector and responds remarkably to the slightest excitation from electromagnetic waves or static induction. Having perfected this method for localizing breaks in telephone wiring, a close resemblance was observed between the apparatus and a miniature wireless-telegraph sending station. The details of the apparatus, fortunately, were of a simpler and, necessarily, of a different design from those of a wireless station owing to the fact that neither a deafening spark nor high-tension currents can be tolerated on telephone lines or cables, as they would seriously interfere with transmission and insultation, and would carry beyond the break and possibly cause injury and damage to subscribers and property.



Antenna Connections.

The sending outfit being identical—from a purely theoretical point of view—in the two cases, one could not help thinking why the receiving station should not be the same, and why, in particular, it should not be used for wireless telephony. To this end it was necessary merely to change the sending station to a talking circuit. An operator's telephone set answered the purpose. A few dry cells were put in series with the transmitter and the primary side of the induction coil. One terminal of the secondary was grounded, the other one serving as the sending antenna, as in-

dicated in the accompanying illustration. The receiving station consisted of nothing more or less than a telephone receiver with one terminal connected to the body (ear or finger) and the other one to a wire which trailed on the ground or was directly connected to ground for the purpose of better receiving. The results were as anticipated. The sounds were audible a few feet from the antenna.

Further experiments with a phonograph, in connection with a small step-up coil, such as is used in wire-telephone practice, brought out the fact that the phonograph could be heard through the receiver anywhere in a good-sized living-room when the wire was concealed under the rugs. Metal, such as a brass bedstead or a tin roof, readily takes up the waves, acts like a sounding boarding and gives them off with seemingly increased strength.

The writer could not make any further investigation on the subject. It seems, however, that good results could be obtained by taking into account the standard methods and apparatus which wire-telephony has established and which have reached such a high degree of development.

It is doubtful whether a transmitter of the present type will ever be developed to withstand currents strong enough to serve directly for wireless transmission. However, there is no doubt that combinations of this transmitter with generators, transformers, arc lamps or coils can be made which will be able to transmit sound within the limits of any city, and for overland or oversea transmission very high frequency waves can be used as the carrier.

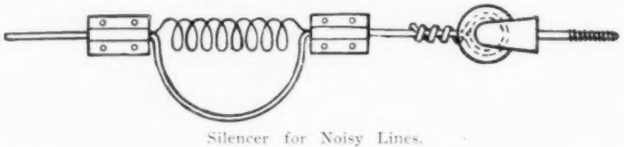
Like present-day telegraphy the method described has the disadvantage of publicity, and even more so since anybody equipped with a receiver can pick up the message; for the same reason it also has the good side—though it is only one-way transmission—that it is accessible to everybody, rich or poor.

A city equipped with such a station could, for example, send out orders to the whole police force in an instant, publish election or ball-game returns, give free concerts to the whole population and accomplish a good many other things which would tend to better the social life of its citizens.

Noise Caused by Wires

MR. F. K. MARTIN, town electrician of Battleford, Sask., contributes the following interesting item to the *Canadian Electrical News:*

"I have had several complaints from customers who claim they could not sleep, on cold nights, owing to the noise caused by the service wires. I have



Silencer for Noisy Lines.

tried several times to overcome this trouble, to the satisfaction of the customers, and finally with success.

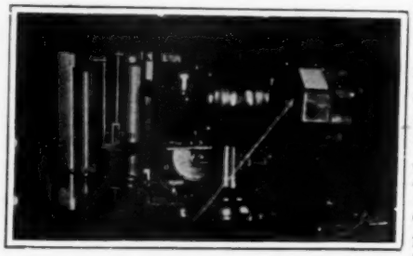
"I got a ¼-inch coil spring, 1½ inches by 10 inches and placed it on the wire with two clamps as in the drawing. This takes the direct strain off the side of the house which acts as a sounding-board.

"This suggestion may be of benefit to some of your readers who have experienced the same trouble."

The "Telegraphic Eye"

THE three accompanying illustrations show a diagram and general view of the latest form of "telegraphic eye" designed by Prof. Rösing, of the Imperial Technical Institute in St. Petersburg, according to Dr. Robert Grimshaw in the *Scientific American.*

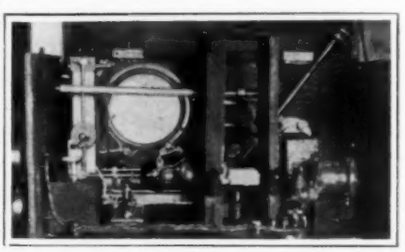
In the general view both the sending and the receiving station are shown, connected by six conductors. It may be mentioned that the inventor has recently worked out an arrangement with only three lines of conductors.



The Transmitter.

The sending station is shown on the right-hand side of the plan, the receiving station on the left. The transmitter consists of two rotating multiplying mirrors, *A* and *B*, the axes of which lie at right angles to one another; their rates of revolution are purposely made unequal, and are so calculated that during their rotation every individual point of the image *M′ N′* of the object *M N*, which it is desired to reproduce at the receiving station, comes in turn before the opening *a* of the diaphragm of the photo-electric receiver *F*. The mirrors operate a number of small dynamos *p p′ p″* and *q′ q q″*, which, when the mirrors are rotated, generate electric currents, synchronous with the movements of the mirrors themselves, and also with those of the images to be transmitted. These currents, as also those proceeding from the photo-electric element *F*, when the light from the individual points falls on this latter, are reproduced at the receiving station.

At this last a pencil of cathode rays produced in a Crookes tube forms an essential feature. In obedience with the electro-magnets *s* and *t*, which are excited by the currents proceeding from the dynamos *p* and *q*, the pencil of cathode rays is deflected by varying amounts in the direction of the two- co-ordinate axes, synchronously with movements of the picture *M N* with reference to the corresponding axis. As a result, the spot of light formed at the point where the pencil of cathode rays meets the fluorescent screen *O* will go through the same movement in relation to the screen as the opening *a* does relatively to picture *M′ N′*. At the same time the spot will change in brightness in proportion to the brilliancy of the corresponding points of the picture *M N* (and hence of the object *M′ N′*). This result is attained by connecting the photo-electric element *F* with the condenser *C* in the Crookes tube, so that the latter becomes charged more or less strongly, in proportion to the intensity of the light falling upon *F*. The con-



The Receiver.

denser, accordingly attracts the pencil of cathode rays with a varying force, and compels it to pass more or less completely through the opening of the diaphragm *o*, and to fall on the fluorescent screen.

As Prof. Rösing's experiments have shown, and as one would expect, considering all that is known of the cathode rays, this form of electric telescopy has yielded results such as have been obtained with none of the earlies forms of aparatus, in which mechanical movements are made use of at the receiving station. We know that the cathode rays have practically no

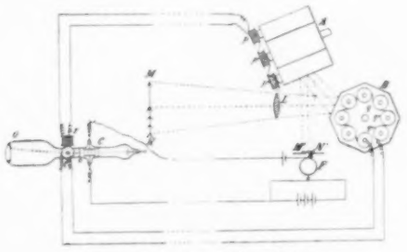


Diagram of the Rosing System.

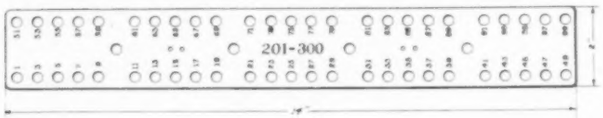
inertia, no friction, and are not subject to vibrations; in other words they possess none of the undesirable properties which limit the action of the most perfect mechanism, especially considering the great velocity of motion required in the reproduction of visible signals by means of the electric telescope. The time admissable for giving a signal may here amount to only a few millionths of a second.

A Wrinkle in Cable Splice Tags

A CABLEMAN for the Michigan State Telephone Company describes in an incidental way, in the course of a narrative entitled "The Confessions of a Cableman" in the *Michigan State Gazette* for February, 1911, a clever little "contraption" for making work easier in grouping pairs while splicing cables. In his own words:

"I had a four hundred pair cable open and in splicing I split a pair and spent nearly a whole day opening up splices, testing and getting the conductors through straight. But I got them. The next morning the foreman came to me purple in the face.

"'For the love of Mike, what in Sam Hill did you



A Handy Cabling Tag.

do all day yesterday—go fishing or to the ball game? You certainly wasn't on the job!'

"And I told him.

"'That's it! You're crazy—crazy as a loon! Don't you know that I have to get this work done to hold my job. Don't you know that you can pick up a split pair and that they will work alright even if they don't go through straight? If they won't work can't you kill one of them? The company won't go broke on one pair of conductors lost—anyway they ain't going to use all these for years. We'll all be dead or far away by that time.'

"There is one thing that I won't do for any man and that is steal! Yes, steal- I happen to know the cost of this estimate and what cable is worth. I know that every pair of conductors in this job is worth just fifty dollars and if I kill one to save a day's work I'm stealing fifty dollars of the company's money. Even if you don't have to kill 'em a split pair will never work without cross talk or a noisy line—I know, I've fixed some of them in the last six months.

"That afternoon, after realizing all forenoon that I had wasted the company's time straightening out my own mistake, an idea came to me. Like the way we feel about most of our mistakes, my mistake had its excuses. When you have 1,600 wires all pointing up in your face it isn't the easiest thing in the world to get the whole bunch together, each with its mate. They were all tagged to be sure, but you had to pick up the particular tag out of 400 that went with another particular tag out of 400. My idea was *group them!* Put all the 1 to 50's together—the 51 to 100's, and so on! How? Take one big tag for each 50 pair! What kind of a tag? Why, a leather tag. Make it about the shape and size of a razor strop; punch holes in it from 1, 2, 3, up. That night I got the leather, punched it and the next day I had a chance to try it out. It worked fine; it was soft and flexible and could be bent or twisted out of the way and easily covered over when you wrapped up the splice for the night to finish next day. Like the installer with the soap and napkin, I had found something!"

Speech by Molecular Vibration

ONE of the early discoveries in electro magnetics was that at the moment of switching on the current an electro-magnet emitted a peculiar sound, which became known as the "magnetic tick," said Thomas Pettigrew in a talk before the Glasgow Telephone Society. The sound is more of a dull thud than a sharp note, and is very suggestive of a kind of molecular shudder which passes through the iron.

It has also been known for years that with the diaphragm removed, provided one listened very intently, speech could be heard in a receiver. I would not go to the length of saying that this effect could be observed with every receiver, but that it can be observed with some is an indisputable fact.

Again, soon after the introduction of omnibus line working in Glasgow the electricians and others of the staff were sometimes rather startled to hear a conversation reproduced by the relays. This effect has all along the line been associated with the 1,000-ohms double make-and-break Ericsson relay as fitted in the party line cord circuit, but when I came to analyse this speaking effect I found considerable difficulty in offering any feasible explanation. Indeed, I came to the conclusion that the relay ought *not* to speak.

The matter seemed to call for further investigation, and accordingly an experimental circuit was set up, and, with the assistance of Mr. A. Browne, a thorough investigation was made. We proved to our complete satisfaction that the 1,000-ohms relay plays little or no part in the effect referred to, and that the speech reproduction is entirely due to the receiver action of the two 500-ohms party line relays. It is interesting to note, however, that with a howler connected to a party line circut the sound can be heard not only in the three relays, but also in the condensers.

It is very curious that, notwithstanding the many indications which telephone engineers have had that molecular vibration in iron could produce speech, the matter was left for a German professor to investigate. The research proved very successful, as beginning with special apparatus the professor was led to try

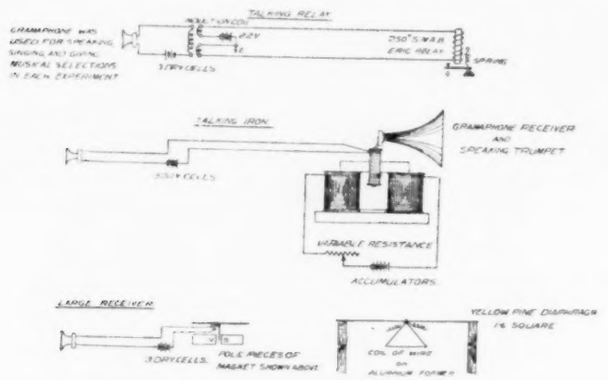


Diagram of Speech Reproduction Experiments.

large masses of iron, and in each and all cases he found that the iron could be heard speaking. His last experiment was made on a dynamo. The armature was disconnected from the field magnet, leaving the two free to be coupled up to different circuits. The field was excited from a set of storage cells. An ordinary telephone transmitter was connected across the armature connections, and it was found that if the ear were placed on the field magent yoke, words, singing, laughing, etc., spoken into the transmitter were all distinctly reproduced in the mass of iron.

The professor published a paper on his discoveries, a translation of which appeared in one of eth numbers of the *Post Office Engineers' Journal*. In that article the bare facts are recorded, and there is little to assist one in reproducing the experiments. I have experimented on dynamos, motors, induction coils, repeaters, relays, etc., and have succeeded in getting the effect in every one of them. The difficulty was, howexer, to obtain results, which could be heard all over a large room. I struck the idea of using a gramaphone receiver and speaking trumpet to pick up the mechanical vibrations in the iron and reproduce them as speech, and experiment showed that this added to the results obtained. After experimenting with every conceivable kind of coil, etc., very good effects were obtained latterly with the coil and core of a pilot relay as shown in the diagram.

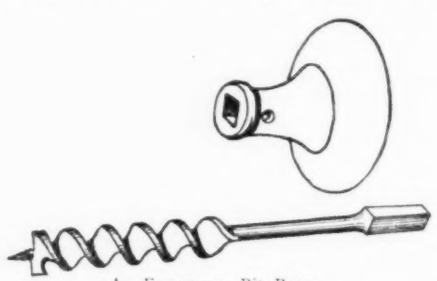
And now a word in explanation of this phenomenon. A very strong magnetic field is required, so that we may look upon the lines of force as being comparable to violin strings. The molecules in the iron mass are all perfectly lined up to lie along the lines of force. The transmitter currents deflect the main field to a varying degree, first in one direction and then in another, and the molecules in the mass follow these movements, set the whole mass of the iron in vibration, and speech is reproduced. The transmitter currents may therefore be said to pluck the taut violin strings, set them in vibration, these in turn setting the molecules in motion, so producing speech in the mass.

As a last experiment I attempted the reproduction of speech by a giant telephone receiver, which, as far as I know, is quite original in design. The idea occurred to me while puzzling out anothe piece of apparatus in connection with our experiments. A rough model was made up, and we obtained startlingly good results right away. A coil of wire is attached to the centre of a thin pine diaphragm and is free to move vertically between the pole pieces of a powerful electro-magnet. The transmitter currents are passed through this coil direct, and a vertical motion is produced, upward or downward, according to the direction of the current.

The arrangement is therefore surprisingly simple; indeed, I made up a receiver in which a coil was fixed to the bottom of a cigar box, and splendid results were obtained.

An Emergency Bit Brace

IT often happens when one desires to use a bit in a corner, that a ratchet brace is not at hand, or that when a bit is required for use no brace at all is at hand, says Claude L. Woodley in the *Scientific American*. "In such a case a door knob from any convenient door may be used. The square hole in the knob



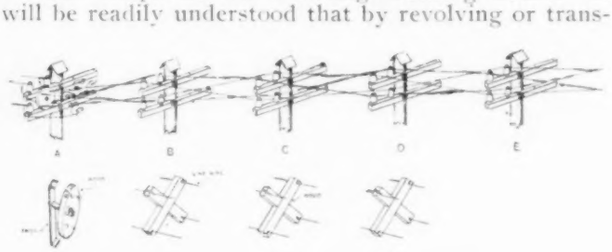
An Emergency Bit Brace.

will permit of its being slipped over the shank of the bit, and the bit may then be turned quite successfully by grasping the knob with the hand.

English Trrnsportation System

AN ingenious arrangement for transporting wires is described by a writer in the London *Electrical Review* under the title "Aerial Telegraphs on English Railways," and illustrated here.

"Its special object is to accomplish the twisting of four telephone wires during working hours. It will be readily understood that by revolving or trans-



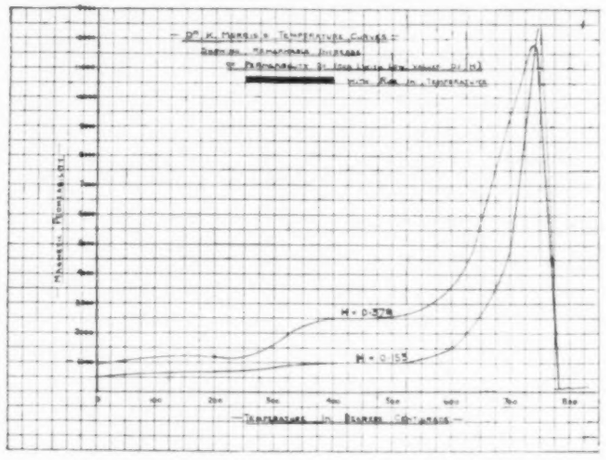
Transposition Scheme Used on British Railways.

posing the telephone wires, inductive disturbances arising from neighboring telegraph wires can be avoided. Let it be assumed that four wires, hitherto run on the straight, have to be transposed. The first operation is to unbind the wires on four consecutive poles, insert the revolving drum on pole *a*, and join the four wires thereto, through the ordinary tension vice—

connecting the line wires across the pole by means of loose wire. The remaining poles *b*, *c*, *d*, are each fitted with a × piece of wood, the size of the latter being determined by the available arm space. The wires having been temporarily removed from the insulators are then inserted in a separate groove, one at each extremity of the wooden × piece. Thus furnished with the necessary equipment, the twist is made by the workmen—one of whom is up each pole—and the time occupied in carrying out an alteration of this kind is less than a minute. In practice, eight spans are usually dealt with at one time, but in order to simplify the explanation only four spans have been referred to. Experience has shown the wisdom of running two or four new wires on the straight, and afterwards revolving them in the manner stated.

Effects of Temperature on Magnetic Properties

IF a thick sheet of iron be made white-hot and allowed to cool in a dark room, a very remarkable effect may be easily observed. As the iron gradually cools, its coloring passes from white through orange to red, but at a certain moment the cooling iron sud-



Temperature Curves in Magnetic Iron.

denly brightens up again, then gradually cools to blackness. The point of the re-brightening is known as the "temperature of recalescence." The theory is that at this particular moment, owing to some molecular change or reconstruction, there is a sudden release of energy, resulting in the reheating of the mass. Perhaps some of the thinkers who go deeply into the structure of matter may be able to advance some theory in explanation of the phenomenon. So far as I know no satisfactory explanation has ever been offered, says Thomas Pettigrew in his paper on "Iron In Its Relation to Electrical Engineering."

However, one fact—one very significant fact—we do know, viz., that above the point of recalescence temperature, iron is no longer magnetic, or very feebly so, and that in cooling it is at the moment of re-brightening that it regains its magnetic properties. Different kinds of iron show different temperatures of recalescence.

With magnetic fields of ordinary strengths a rise in temperature results in a falling away in the magnetic properties of the iron. I speak now of temperature rises of hundreds of degrees centigrade.

At a very low magnetizing values however, this order of things no longer holds good, as will be seen from the two remarkable curves in the diagram. These curves are due to Dr. D. K. Morris who carried out a very exhaustive reseach on this subject.

It will be seen that between 600 degrees and 750 degrees centigrade, the iron becomes remarkably sensitive to weak magnetizing forces, and magnetization results are shown which at ordinary temperatures would require the application of a much stronger magnetizing force.

The condition of the iron, however, is very unstable and a small percentage variation in the temperature, up or down, brings about a disastrous falling away in the degree of magnetization. Very considerable difficulty lies in the way of taking practical adantage of this peculiar property in iron. The high temperature, the constancy of temperature required, insulation troubles, etc., all militate against its practical application.

This remarkable effect seems to be due to the molecules of the iron being in a very sensitive condition, probably the result of the expansion of the mass, and if the iron could be fixed in this condition at ordinary temperatures, it would find extensive application in iron-controlled sensitive instruments of all kinds.

Nothing seems more likely to bring about such a result, than the addition of some material which will act as a kind of molecular lubricator.

Michigan Bill Gives Commission Control

The Giles bill to make telephone companies of Michigan common carriers has passed the house, with an amendment that takes from municipalities and townships the right to grant telephone franchises and regulate rates and vests it absolutely in the state railway commission.

The bill, in substance, would require a big company to give connection over its wires anywhere in the state to any subscriber of a smaller company when a subscriber could not reach the person desired using only the wire service of the smaller concern; providing the railroad commission decided that it was a public necessity to provide facilities for such a service. A penalty specified in the bill is forfeiture of the franchise of the company that refuses to permit the use of its wires by another company to enable the latter company to give more extended service than it could with its own wire equipment.

No "Hello" in Navy

"Hello" has been banished from the telephone service of the navy department. Any of the officials or employes at yards and stations in the United States, instead of answering a telephone call by "hello" will give their name or the name of the office.

Secretary Meyer believes that to say "hello" to every telephone call is a waste of time and that if persons answering the telephone will reply by their name or the name of the office, some of which are half a yard in length, time will be saved. At any rate, the secretary says mistakes in telephone numbers will be more quickly remedied.

Telephone Progress in McPherson, Kansas

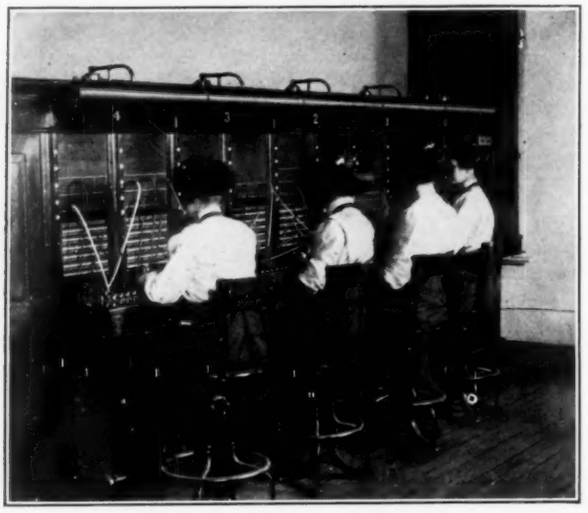
By Charles F. Morris

JUST fifteen years ago the McPherson Telephone Company started its career. Service was established, with forty-eight subscribers at the start. It was a modest beginning, but the growth in size and in importance has been as steady as has been the increase in population and prosperity of McPherson itself, situated in the center of the rich agricultural section of Kansas. The company outgrew its original equipment, and has just put into service brand new facilities for handling subscribers' and rural lines.

At present the company is managed by a board of seven directors, and the system is owned by the business men of McPherson. There are seventy-two stockholders, and the institution is in every sense a home concern.

It had been apparent for some time that the increased patronage of the company made necessary a betterment of the equipment. Last year the officers started an investigation to find out for themselves what was the best type of equipment for their telephone system. A number of cities were visited, and both magneto and common battery systems were observed in operation. There had been a demand among business men in McPherson for the central battery method of operation, and it was decided to agree with the sentiment of these people and to discard the magneto equipment of the city lines.

A proposal of the Western Electric Company was accepted and a central battery equipment, conforming in every way with the best telephone practice, was purchased and installed in the McPherson

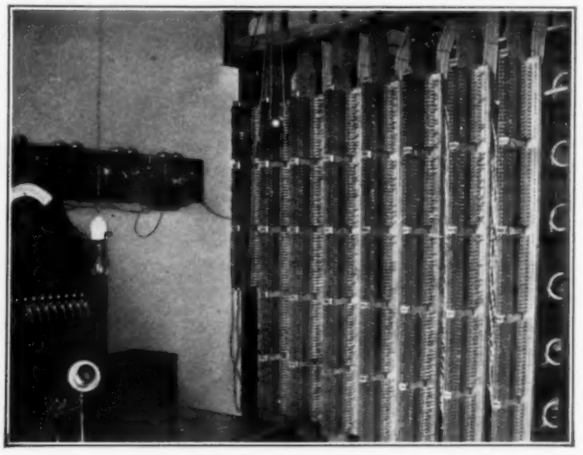


Subscribers' and Rural Positions, Operating Room, McPherson, Kans.

exchange. The company now occupies the second and third floors of the Farmers' and Merchants' Bank Building. The installation of the new equipment makes practically a complete new exchange.

The new board consists of five operators' positions. Two operators handle the subscribers' lines, one takes care of a combination subscribers' and rural section, there is one rural section, and the equipment is completed by a special section employed for toll switching and night toll service.

In providing facilities for this exchange ample provision was made for future growth. The McPherson Telephone Company expects to be larger than it is now, and has planned this exchange with a



Wire Chief's Desk and Protector Equipment at McPherson, Kans.

view to taking care of a large number of additional lines. Its ultimate capacity is 1,600 lines, and at present it is equipped with 600. There are twenty outgoing trunks, with a capacity of twice that number.

The equipment further consists of 140 combined jacks and signals for the rural and magneto party lines. There are ten combined jacks and signals for night service on the toll switchboard. Five outgoing call wire circuits have been installed, with a capacity in the exchange for eight.

There are two cable turning sections. Cable, racks, distributing frames, supervisory equipment, harmonic converters and a power plant consisting of a storage battery equipment and mercury arc rectifier, have been provided.

The main distributing frame contains on its horizontal side the full equipment of eight shelves. The ultimate capacity is 320 lines per shelf, and the present equipment is 160. There are eight verticals for the protectors, half as many as are provided by the ultimate capacity of the frame. The total number of protector lines is 800.

The wire chief's desk is arranged for one operator. It is wired for a testing circuit, two test lines to the main frame and two to the switchboard; two incoming trunks (ultimate capacity five), and telephone, ringing, call wire and buzzer circuits.

Provision has been made for one chief operator. The C. O. desk contains five incoming trunks, four monitoring key circuits, four line monitoring lamps and four cord supervisory monitoring lamp cir-

suits. There are also the usual double and single cord, telephone, ringing, buzzer and call wire circuits.

Since the equipment was installed the service has been so satisfactory as to justify the officers of the company in the step they took in securing a strictly up-to-date equipment.

Wisconsin Commission News

The case of the Troy and Aoney Creek Telephone Company, in which it made application for an increase of rates from $1.00 to $1.25 and $1.50 for residence and business telephones respectively, has been dismissed by the Wisconsin Railroad Commission. Opposition to the increase was on the grounds that the service was not satisfactory and that with proper management the present rates should yield ample returns on the investment.

The commission has also rendered a decision regarding application for increase in rates by the Milton and Milton Junction Telephone Company. Claiming increased cost of labor, material and supplies as its reason for so doing, the company sought to increase its rates from $1.50 for business and residence individual lines, $1 for business and residence four-party selective, and $1.25 for rural telephones, to $2 for business telephones, individual; $1.50, four-party; $1.50, residence telephone, individual; $1, four-party; $1.50, rural telephones. On inquiry it was developed that prior to the last fiscal year no depreciation account had been maintained. As a result renewal requirements far exceed depreciation allowance, and the commission held that the company is not justified in placing the cost of past depreciation on future telephone subscribers. It was considered that operating revenues at the present rate were sufficient to give a fair return upon the investment, with depreciation computed at seven per cent, and that the proposed rates would yield too great a return. The commission thought it advisable to reduce the proposed rate for rural telephones from $1.50, as requested, to $1.25, and with this modification to authorize the company to adopt the proposed schedule.

The Law and the Telephone

By E. J. Wenner

TELEPHONE COMPANY INCREASES RATES—RAILROAD COMMISSION GIVES PERMISSION—CITY FRANCHISE RATES GOVERN.

IN 1908 the City of Dawson, Georgia, granted a franchise to the Dawson Telephone Company for the operation of a telephone exchange within the corporate limits of the city. The franchise provided that the company might charge $1.50 per month for residence telephones and $2.50 per month for business telephones.

The telephone company spent a large amount of money in installing a new and modern plant and in improving its service. It was then found that the income was not sufficient to make a profit for the stockholders.

A petition was filed with the city council asking permission to amend the franchise so as to increase the rates. The petition never came to a vote in the council, but after a careful investigation it found that the plant could make no profits at the rates charged and gave permission to increase the monthly rental.

At a recent meeting of the city council a resolution was adopted instructing the city clerk to prepare a notice and serve same upon the company notifying it that it must comply with the franchise rates and must refund to the subscribers any increase in rates collected from them, or show cause, if any, why the franchise should not be revoked and annulled.

DAMAGE FROM LIGHTNING STRIKING WIRES—PROPERTY DESTROYED BY FIRE.

The Preacher Mills Company brought suit against the Cumberland Telephone and Telegraph Company in the Circuit Court of Clarksville, Tenn., asking for damages in the amount of $50,000 on account of destruction of property by a fire claimed to have been caused by improper installation of defendant's telephone instruments, allowing a bolt of lightning to be conducted into the plaintiff's store building, setting it on fire. The case was tried to a jury and a verdict in favor of plaintiff for $10,000 and interest was returned. There will no doubt be an appeal of this case.

INJUNCTION RESTRAINING COMPANY FROM FURNISHING SERVICE.

In the suit of John Nicholson against Edward Alvey and Western Union Telegraph Company and the Cumberland Telegraph and Telephone Company, in Louisville, Kentucky, the defendants were enjoined from furnishing reports from race tracks to alleged pool rooms operated in Louisville by Mr. Alvey.

It was claimed by the plaintiff that he lost $12,000 on horse races in a room operated by the defendant, Alvey.

LARGE RENTALS AND ROYALTIES FOR TELEPHONE LICENSES.

In the Circuit Court of Appeals in Boston, Mass., the Western Union Telegraph Company was awarded $2,579,914.64, which represents certain shares of stock received by the American Bell Telephone Company from other telephone companies under license contracts.

TELEPHONE COMPANY INVOLVED—FORECLOSURE PROCEEDINGS.

Russell Brewster & Co. of Chicago have filed a suit for $5,000 against the Rough River Telephone Company and John A. Armstrong of Owensboro, Kentucky. The plaintiff asks that the telephone company's property be sold to satisfy the debt.

RATES ESTABLISHED BY PUBLIC UTILITIES COMMISSION WERE VALID IN MISSOURI.

The Supreme Court of the State of Missouri has sustained the validity of an act of the legislature of 1907 establishing a public utilities commission. The case at bar came from Jasper county, where the city of Carthage ordered rates reduced. The Circuit Court held the law unconstitutional on the gound that it

sought to put into effect rates which were confiscatory. The Supreme Court holds the act valid and that the rates established were just and reasonable.

COUNCILMAN SUED FOR TELEPHONE RENTAL.

The Gage County Independent Telephone Company has brought suit against Dell A Lasher of Beatrice, Neb. Plaintiff claims Lasher is owing them $25.90 as dues from April, 1909, to August, 1910, and asks judgment for this amount. Lasher is a resident and councilman of Wymore.

INJUNCTION TO RESTRAIN TELEPHONE COMPANY FROM REMOVING TELEPHONE INSTRUMENT.

In the Court of Civil Appeals in Dallas, Tex., Rev. John L. Andrews brought suit against the Southwestern Telephone and Telegraph Company to restrain the company from removing its instrument from his residence because of alleged non-payment of rental bills.

A decision was rendered by the judges in which it is ordered that the case be reversed, the injunction dissolved and the case dismissed.

The plaintiff claims to have complied with all the requirements of the so-called initiative and referendum ordinance and has appealed the case that a higher court may pass upon the question.

TELEPHONE LINEMAN KILLED BY HIGH POWER WIRES—RECOVERY HAD IN SUIT FOR DAMAGES.

The Texarkana Gas and Electric Company was held liable in damages on account of the death of J. Powell, a telephone lineman, who was injured because of coming into contact with a heavily charged wire of the defendant. A jury rendered a verdict awarding damages in the sum of $12,500, of which amount the widow received $5,750, a child $5,750 and the mother of the decedent $1,000.

The suit was originally brought against this defendant and the Southwestern Telephone and Telegraph Company, but was withdrawn so far as the Southwestern was concerned.

It is believed the case will be appealed.

RESISTANCE TO ORDINANCE REDUCING TELEPHONE RATES.

A case has been pending for some time in the Federal Court at Louisville, Ky., in which the city is attempting to establish the validity of an ordinance requiring a reduction of telephone rates. The Cumberland Telephone and Telegraph Company has introduced its evidence in attempt to show the ordinance confiscatory and illegal.

The court has asked a re-argument upon several

CITY CLAIMS FRANCHISE NECESSARY TO OPERATE EXCHANGE AND CONSTRUCT LINES.

Four linemen in the employ of the Central Union Telephone Company were arrested by the police of Averyville, Ill., while at work installing an instrument on N. Adams street in said village.

The defendants were charged with constructing a telephone system in the village without the legal right afforded by a franchise, and it will be interesting to await the outcome of the case in view of a recent holding of a supreme court to the effect that a telephone franchise is not always necessary to permit a telephone company to construct its exchange within the corporate limits of a municipality.

In this particular case the village contends that the franchise of the defendants expired in 1907, and that since said date it has operated in the village without permission. Three months ago the village authorities drafted a new franchise and presented it to the telephone company for acceptance. The company refused the measure on account of a provision requiring the removal of certain poles from certain streets, and after the refusal the village served a thirty days' notice upon the company to remove its lines.

points, among which are expenses, value of franchise, depreciation and number of telephones.

At present it seems the evidence shows the ordinance is not confiscatory, but on the contrary provides for fair and generous rates, and it is shown the company has paid good dividends upon its present valuation.

The present contention is largely over the question of the Special Master's 10 per cent reduction on the value of the plant. It is claimed by the defendant that such a reduction gives an unfair value to the assets of the company.

SUIT FOR WRONGFUL REMOVAL OF TELEPHONE.

S. W. Sutton has filed suit in the City Court of Birmingham, Ala., against the Southern Bell Telephone Company, asking damages in the amount of $500 on account of unjustly and unlawfully disconnecting plaintiff's telephone and removing the same from his residence.

CLAIMS DAMAGES FOR NON-DELIVERY OF MESSAGE—CALL FOR A PHYSICIAN.

Rosa E. Bartlett of Memphis, Tenn., brought suit against the Cumberland Telephone and Telegraph Company, claiming $10,000 damages for failure to deliver a message to a physician, which message called him for assistance on a sick child. The message was not delivered in time and the child was dead before the physician arrived.

A large portion of the damage claimed is based upon anxiety by the mother because of the delay in delivering the message.

The jury gave plaintiff a verdict for $300.

The Oklahoma Corporation Commission

At a recent meeting of the Electric Club of Chicago George P. Player, telephone engineer of the Corporation Commission of Oklahoma, gave a short talk on the work of the commission. The commission, which was established about three years ago, has supervision over the public service corporations of the state. At present it is ascertaining the cost and replacement cost of the properties of all public service corporations. It requires the companies to make sworn reports giving the cost of all parts of their plants. The replacement cost is ascertained by taking an actual inventory of the plant, which has been done in several cases by the telephone department of the commission. The attorney has asked for a rehearing in the Enid telephone case in which the Supreme Court of the state reversed the 2decision of the commission when the latter ordered the Pioneer Telephone and Telegraph Company not to make a proposed increase in rates, and Mr. Player is hopeful that in case it is granted the commission will be more successful. It is the purpose of the commission to be helpful to the companies as well as the subscribers.

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

A CONSPICUOUS chin, a massive jaw and a strong set of ivories do not always imply abnormality by training. Some men have these characteristics because they have hung onto their jobs with their molars. George Jacob Yundt cannot be thus accused. George is one of the best little hangers-on you ever saw, but he doesn't hang by his teeth. Far be it from. A job to George Yundt is like quicksand. It swallows him up—or, rather, he swallows it up. If he accepts a job, you can ask the job about George or ask George about it—the answer will be the same.

It were ever that way. He started in a drug store and he is now chief engineer for the Southern Bell T. & T. "I don't know where I'm going, but I'm on my way" has no terrors for Yundt. In truth, he doesn't know where he's going, but in like truth he's on his way.

Mr. Yundt is a good example of the opportunity a telephone offers to the stick-to-it type of young man. He joined the Southern Bell engineering force in 1899, and now the engineering force joins him. He tops the list. And figuring by and large, twelve years isn't very long to take the measure of a job like that. But hold—Yundt has been the Southern Bell's chief engineer for lo, these many years. To be specific, five and a half—which shows clearly that from his inauspicious start in 1899 till February, 1905, he turned the trick.

He Started in a Drugstore and He Is Now Chief Engineer for the Southern Bell T. & T.

As a matter of fact, he turned several. It happened like this: C. W. Burkett offered that first telephone job which Yundt accepted. C. H. Wilson, general manager of the Southern Bell, had a mania about then to improve the common battery system at Atlanta. Mr. Wilson saw that Yundt was itching for more things to do, so he was detailed to make a study of conditions and report them with recommendations. You know how it is with some of these enthusiasts who don't know any better than to work their heads off! Yundt waded in, and in three months his report had the approval of the engineers. The company was pleased—it is self-evident, because Yundt's salary increase was voluntary.

Put a pin here. You know that the company was pleased! And so they put George Jacob over into maintenance, estimating on construction, traffic studies, commercial and engineering problems. Oh! they didn't show any partiality at all to Yundt. He was a good natured German and there always was a smile in the corners of his mouth and a twinkle in his eyes—so they ladeled it out good and plenty. It ran along that way till '02, when some changes shifted Yundt to assistant engineer. This was under Bangs—not bangs of the department, but Bangs, chief of the engineering staff. In less than a year Bangs joined the Central Union and Yundt assumed Bangs' duties down there in Atlanta, but not the title. That's an old habit of the bigger corporations. They let you do the bigger work on the same old pay. If you chafe a lot, you are not a good Indian. But Yundt didn't chafe, he just "ate it up" and stuck. A year and a half later E. J. Hall, president, let his foot slip—or maybe it was his pen—and drew a line through the words "Acting Electrical" and let it go as straight "Engineer." Of course there weren't any more rungs on that ladder, so there you are—George J. Yundt, chief engineer of the Southern—and adviser plenipotentiary to the vice-president in charge of operation.

George Jacob Yundt was born in Weisport, Pa., August 3, 1876. His pioneer ancestors settled in Delaware, but afterwards followed William Penn into Pennsylvania, where the families remained. It was in Weisport, at the age of twelve, where Yundt started to mould pills on rainy days and do other odd jobs around a village drug store. He left that business after a little while, to become a clerk in the employ of the Central Railway of New Jersey.

When he was nineteen, having saved a few hundred dollars, he quit the railroad and prepared for his college entrance examinations. Remember that place where he was born, don't you? It says something about wise, only it is spelled differently. It is thus accounted for—that money Yundt saved and this step into college. It is great to be born in a wise port! Anyway, believing in keeping your money at home, Yundt put his into the Pennsylvania State College and entered the freshman class in 1895. As a student. But what's the use? Can you imagine a youth of tender years with callouses on his hands, denying himself those things he would rather have and saving to go to college, being any other thing

than a *student?* That's what he was. His activities were everywhere. Anything that looked like work from the social to the dramatic. He organized the literary society—edited the college magazine—did the leads in the dramatic club.

He graduated after a time, in debt financially, but with a surplus in learning and the title Bachelor of Science.

Mr. Yundt isn't through. He hasn't reached the full measure of his possibilities. His life is devoted to fitting himself for larger responsibilities—the handling of bigger things. He combines rare executive ability; his work is marked by simple methods; he is a technical expert. And you can't fool him. He is in touch with commercial and industrial development, loves the South, is a keen judge of men, a good listener and has everybody's confidence.

Clubs? Yes. Just a little time for them, however. Associate member of the American Institute; member of the Capital City Club and the Piedmont Driving Club. And they do say a riding habit fits him almost as perfectly as he fits the Southern Bell.

The Iowa Convention

At the annual convention of the Iowa Independent Telephone Association, recently held in Fort Dodge, resolutions were unanimously adopted endorsing the control of public utilities by state commission, the extension of membership to owners of independent telephone companies regardless of the fact that such systems connected with the Bell company, and the appointment of a committee to draw up a form of interconnection contract which should be applicable throughout the state.

J. M. Plaister, president of the association, gave an interesting address, in which he outlined the situation as it is today and urged the importance of adopting some method which would be adequate to handle the new conditions of the present and those which should confront them in the future. He gave it as his opinion that the association had erred in the past in its attitude toward the small independent companies that made connection with the Bell and suggested that a new policy should be formed, giving it as his belief that the articles of incorporation should be revised.

Mr. Plaister was followed by P. C. Holdoegel, who set forth the need of organization in order to bring about regulation of public utilities by the state rather than by municipalities. He expressed his belief in the necessity of the association bringing about improved service and his confidence in its ability to work out something practical along the lines referred to.

J. C. Kelsey gave a short review of the situation in Iowa as it appeared to him, and expressed himself as well pleased with the outlook. He spoke in favor of interconnection and stated he would like to see the association reorganized to let everybody in.

H. S. Ash, from Bedford, presented a plan of reorganization which was intended to perpetuate the association. He suggested a universal form of interconnection contract should be adopted and employed in every case for the protection of the smaller companies. Mr. Ash, A. J. Westphal, from Sioux City, and M. Fretz, from Harlan, were appointed a committee by the president to draw up such a contract to be submitted at a later date.

A committee consisting of J. C. Kelsey, H. B. Shoemaker, H. S. Baker, H. S. Ash and P. C. Holdoegel was appointed by the president to amend the present constitution along the lines discussed, and after the words "non-Bell" were stricken out the document was adopted, which pledges the association to regard all independent plants independent regardless of connections and to admit their representatives to membership.

The following officers were elected for the year: President, J. C. Thorne, Fairfield; secretary and treasurer, W. J. Thill; executive committee, the above officers and J. M. Plaister, H. S. Baker, John Anderson of Horning and H. B. Shoemaker of Toledo.

Interstate Commission Issues Official Announcement

The following announcement has been made by the Interstate Commerce Commission, calling attention to the fact that all telegraph and telephone companies doing an interstate business will, in the future, be regulated by the interstate commerce act and that all these companies must file their tariffs or rates on interstate business, and will be held liable for discriminations:

"(1) That each and every telegraph and telephone company which transmits messages over its lines or line from a point in one state, territory or district of the United States to any other state, territory or district of the United States, or to any foreign country, is subject to the provisions of the Act.

"(2) That if a telegraph or telephone company, the line of which is wholly within a single state, territory or district of the United States, received a message within such state, territory or district of the United states, for transmission to a point without the state, territory or district, which it transmits over its line to another point in the same state and there delivers it to an interstate line for transmission to destination, the first-named company, by virtue of its participation in this transaction, is not made subject to the provisions of the Act; unless there be an arrangement between that company and its connection for through continuous transmission of such messages, in which latter case all of the participating companies in such through continuous transmission are subject to the provisions of the Act.

"(3) If two or more lines are connected so that a person within one state, territory or district of the United States talks with a person at a point outside of such state, territory or district of the United States, or so that a message is transmitted directly from a point within a state, territory or district of the United States to a point without the same, the transmission of messages in this manner constitutes interstate commerce and brings all of the participating lines within the purview of the Act.

"(4) It follows that telegraph and telephone companies subject to the Act, as above indicated, must conform to the provisions of Section 1 thereof, requiring that all of their rates and charges for the transmission of interstate messages shall be reasonable and just, and that such companies may lawfully issue franks covering free interstate service or may grant free interstate service to the same extent, and subject to the same limitations, as other common carriers under the provisions of said section.

"(5) Such telegraph and telephone companies subject to the Act are also governed by the provisions of Section 3, forbidding any undue or unreasonable preference or advantage by rebates or otherwise, or any undue or unreasonable prejudice or disadvantage in any respect whatsoever, and are subject to the lawful orders of the Commission made pursuant to the provisions of Section 15 of the Act, and also of Section 20 thereof respecting the keeping of accounts and memoranda and the making of reports to the Commission.

"The Commission at this time withholds expression of its views regarding other questions which have arisen with respect to the amenability of these carriers to the provisions of other sections of the Act."

A company has lately been formed in Moscow namely the Gessellschaft für Telefon Anlagen, to manufacture telephone material.

Digest of Foreign Telephone Literature

Translated for Our Readers

DANGEROUS VOLTAGES IN GROUNDED IRON POLES.

TESTS were recently made by the German testing station to find out the magnitude of the voltage of any point on the ground around the base of an iron pole carrying telephone, telegraph or high tension power lines, in the cases where the insulation of the wires is faulty and the pole serves as an electric conductor. The first part of the investigations deals with the phenomena around the pole, when it is only grounded by the fact of standing on the earth; the action of the earth as an electric conductor; the voltage drop, depending on the distance between overhead wires and the ground; and the influence of the nature of the ground and of the iron pole itself. The second part treats on protective devices to prevent dangerous voltages between the iron pole and the ground.

The resistance and the conductivity of the earth depend on the external properties of the same and its various constituents. The specific resistance depends on two factors; namely, the percentage of moisture in the ground and the intensity and nature of the earth circuit. Frost and heat increases the earth resistance, since they draw away the moisture; rain and dampness decrease it. With high intensity of current the heat effects are also influential and with direct current a nine to ten per cent higher resistance is found than with alternating current. The author explains this by looking upon the earth as having the nature of a very diluted solution of salt (due to the carbonates of lime) which show a great difference of conductivity for currents whose direction have undergone a change. The resistance is decreased considerably when the direction of the current changes (a. c. is here considered as a constantly commutating d. c.). Moreover, the contact resistance between the base of the pole and the earth plays a very important part, since this contact can not of course be very close. The result derived from the tests proves that a pole which is only grounded or earth circuited by the fact of its base being in contact with the earth, can cause high voltages, if the insulation of the wires is impaired or if there are leaks. These voltages can become dangerous to persons standing within a radius of a few inches away from the pole. An ordinary iron street pole carrying wires at only 400 volts, had a voltage of over 200 at a distance of only 20 inches from the pole. This would be of danger to persons who stand nearby and come within this radius with their hands, especially if they should be damp or wet. According to the law found by experiment, that for all distances the values of the dangerous voltages are in direct proportion to the voltages as delivered by the powerhouse, and that these values increase or decrease with the powerhouse voltage, we would have with a voltage of 600 to 700 direct current at a distance of 20 inches from the pole a difference of potential of from $\frac{600}{406}$ 232 equal 345 to $\frac{700}{406}$ 232 equal 400 volts. In computing this voltage for a. c. we must take it 1.4 times as high as for direct current.

It is impossible to find a law which can be applied as a test for this voltage, as the ground resistance is so variable, depending, as it does, upon the nature of the earth and local conditions which are beyond the control of any law. However, the author makes the statement that the dangerous voltage is found at a distance of 6 to 10 times the radius of the pole and that it is 0.7 to 0.9 times the voltage of the current as going over the wires. With a. c. these values must be multiplied by 1.4 to give the effective ground voltage.

The second part deals with protective devices. These may be either indirect or direct. In the former devices, the pole grounded resistance is decreased by a parallel connected earth wire so that a strong earth current will result which will act upon safety fuses or some safety device at the power station and cut off the current or dead circuit the line. This is very unreliable, however, as the earth current depends on the resistance of the second earth wire and upon the amount of power delivered at that time by the power station. If this is small, the earth current will not be strong enough to release the safety devices or that safety cut-outs. The best protection of this type is the parallel wiring of all the poles by means of steel cables which connect all of them, thus causing a very weak short-circuit resistance. A direct effect of protection can be obtained by lowering the ground resistance right around the pole. Such an improvement of resistance can be accomplished by setting the pole in ground which has been filled within a certain radius with coke. Another way is to use metallic bodies like concentric rings, discs, spiral wound wire rope, etc., which are permanently connected with the pole.—*Elektrische Kraftbetriebe.*

A NEW FIRE ALARM AND ACCIDENT SYSTEM WITH TELEPHONE CONNECTION.

The telephone is one of the best means to call aid in any emergency and many of the German cities have instituted a system of telephone connections with hospitals, police stations and fire houses on one side and private houses and business places on the other side. The trouble has been, however, that in most cases connection could only be made from the subscriber to the public department, and not vice versa. Moreover, the lines had to be inspected every evening, as the safety and operation of the system from the standpoint of the subscriber depended on the throwing in of a switch which would place the two lines from house to department into service. This was often neglected or forgotten and the result was that the system did not work and was next to useless. A new system has been worked out recently and been in use for a year with good results.

This new accident call system consists of a central exchange board at the police station, fire depot or hospital, and a telephone system at the subscriber's home. The exchange has the usual equipment, and from here the wires are connected over a 300 ohm resistance direct with earth. There is also a d. c. alarm bell which is connected by a special wire with the armature contact of the calling electromagnets. The rest of the system consists of a step-back relay, an adjusting magnet, and a contact device. The armatures of the two relays act upon an escapement wheel which is connected with the con-

tact roller and the lever arm of the intercommunicating disc by a common axis. One half of the contact roller is of wood, the other half of metal. A metal strip is fixed into the wooden part, and a hard rubber strip into the metal roller. The brush collectors resting on the wooden roller are connected to the *a*-branch of the line, and those on the metal roller to the *b*-branch. The *a*-branches are moreover soldered to the contact pins of the intercommunicating disc.

The action of the device is as follows: If a call is made by one of the subscribers, the proper jack electromagnet closes the armature contact, whereby a current circuit is caused from the 10-volt battery, which sounds the alarm at the fire station. The operator there presses down a button marked "Forward" and through this the two branches of the line are connected over the 300 ohm resistance to earth. The result is a current of about 25 milliamperes which flows through the adjusting and step-back relays. Only the 60 ohm, not the 30 ohm relay is excited. The adjusting relay closes a circuit over the adjusting magnet, which again moves the escapement wheel with the contact roller and the lever of the intercommunicating disc by one cog in a forward direction. In this position the brush collectors of all the *a*-branches touch the metal strip of the wooden roller, and the brush collectors of the *b*-branches touch the bare metal roller, so that all the subscriber's stations are in parallel. The exchange which is also in parallel, on account of the simultaneous moving of the contact lever, can now receive the call. Suppose call station "8" is wanted by the first subscriber. The exchange operator presses a button marked "Forward" eight times, and the cog wheel moves forward eight more cogs and destroys the parallel wiring arrangement or the *a*-branches, leaving the *b*-branches in parallel, and places the lever arm of the intercommunicating disc upon the sliding contact 8. By means of the magnet inductor the operator can now call up subscriber eight and tell him he is wanted by the other caller. To connect the two telephones, the system has to be shunted back to parallel again. This is done by a single pressure upon a button marked "Return" and then of the "Forward" button. The pressing of the "Return" button connects the two wires directly with earth and a 70 millampere current flows through the two relays. The step-back relay responds to this current, short circuits the adjusting relays, which immediately releases the armature and sends a current through the step-back magnet. The latter attracts the armature, which is in form of a pawl, and releases the escapement wheel, so that the latter, along with the contact roller and contact lever, leaps back into the original normal position, acted upon moreover by a powerful spring. The pressure upon the "Forward" button again moves the wheel forward by one cog, so that all the lines are shunted in parallel The calling and the called subscriber can now talk over the wires. The central operator remains in connection during the conversation and at the end switches back both telephones into the position they were in before the calls. This is done by pressing the "Return" button. The system has worked on a small scale in Munich and will now be enlarged and used in the various city departments of that city.—*Zeit. F. Schwachstrom.*

A NEW TELEVISION APPARATUS.

Prof. Rosing of St. Petersburg has perfected a new television apparatus for the long distance transmission of pictures, which he calls the "Electric Eye." It consists of the receiving and sending station, which are connected by four or six wires. One of these stations sends out kinematographic pictures at the rate of about 40 per second. For this purpose he uses two groups of rotating mirrors, whose axes are at right angles to each other. They act upon a so-called photoelement. This photoelement is a ball whose lower half is coated with a negatively charged film of potassium, sodium or rubidium. This mass has the property of discharging under the influence of light. These discharges communicate themselves to the condenser at the receiving station. During the rotation of the mirrors, an alternating current generator generates a pencil of cathode rays in electromagnets which effect the transmission of the pictures. What is really transmitted are the oscillations and vibrations of a pencil of light varying from a bright light to total darkness in degree of intensity. These transmissions are very fast, ranging into the millionth part of a second. A small dynamo does the driving. At the receiving station these oscillations appear in an equally rapid order so that they make the impression of one continuous picture upon the eye of the observer. The photoelement seems to be the most important part of this invention, and it will depend upon the degree of perfection of the latter whether the design will be of lasting value for practical work.—*Zeit f. Schwachstrom.*

THE TELEPHONE SYSTEM OF PARIS.

Paris has about 500,000 subscribers and seven or more large central exchanges and numerous smaller branches. Each of these exchanges has two sets of storage batteries of 24 volts to operate the lines. These sets are used alternately, that is while one set is used, the other is charged. They are charged from motor generators, fed by the public power circuits. One of the large exchanges has also a small petrol driven generator on an automobile truck, which can be used to charge the batteries in case of trouble with the public power circuits, and which can also make the rounds of the exchanges for this same purpose. The battery circuits to the exchange switchboards can be broken in case of necessity by means of an electromagnetic switch, through whose working contact the battery circuit to the switchboard exchanges are closed. The switch is held in working position by the closed circuit as long as the cut-outs at the exchange switchboards, which are also in the closed circuit current, are switched on.

The calling machines or ringers give alternating current at 80 volts and 20-25 periods as also direct current at 40-45 volts. They are fitted with special signaling devices for "busy" and "does not answer" and are fed from the storage batteries.

The outside cables are lead covered with .04 inch conductors and are paper insulated. They are usually in 224-pair cables and 448-pair cables. In the long distance underground conduits, 7-pair cables with 2.5 mm conductors are used. Nearly all of the Paris cables are laid in the sewers of Paris. These sewers have a length of 1,500 km. and are from 10 to 15 feet high and from 3 to 20 feet wide. At present the Paris sewers contain 66 km. 224-pair; 1,170 km. 112-pair; 625 km. 28-pair and 2,700 km. 1-pair cables. They are laid upon special cable holders. They are connected to the houses either through special openings in the cellars direct from the sewers or else are led outside of the house along the walls to the surface and then into the house. The overhead wires are all of 1.1 mm bronze wires in double

lines. In searching for leaks and faults in the insulations of the paper insulated cables, they use compressed air. All the exchanges are connected to the pipes of a private company which furnishes them with compressed air. This air at 5 atmospheres pressure is first sent through a regulator where it is reduced to 3 atmospheres pressure. From there it is sent into the cables in the sewers after being dried by calcium chloride. Every cable at its entrance into the sewers is connected to a compressed air pipe and the air can then be passed through the pipes and the cables, by merely turning a valve at the exchanges. The trouble men then walk through the sewers and examine the cables for the hissing noise caused by a leak in the insulation, as the air escapes from the cable. The Paris telephone office is now working on a scheme to use compressed air in giving notice automatically of leaks in any part of the cables.—*Annales de Postes et Telephones.*

Making Switchboard Signal Lamps

By George Hale

TURNING out tiny switchboard lamps in large quantities is a task that calls for processes of more than usual interest and involves operations that are extremely delicate. When it is remembered that the dimensions of these lamps have been fixed at 1¾ by 5-16 inches and that the carbon filament generally used has a diameter equal to that of the human hair, it may easily be said that the efforts of the manufacturers to obtain an efficient lamp have been highly successful.

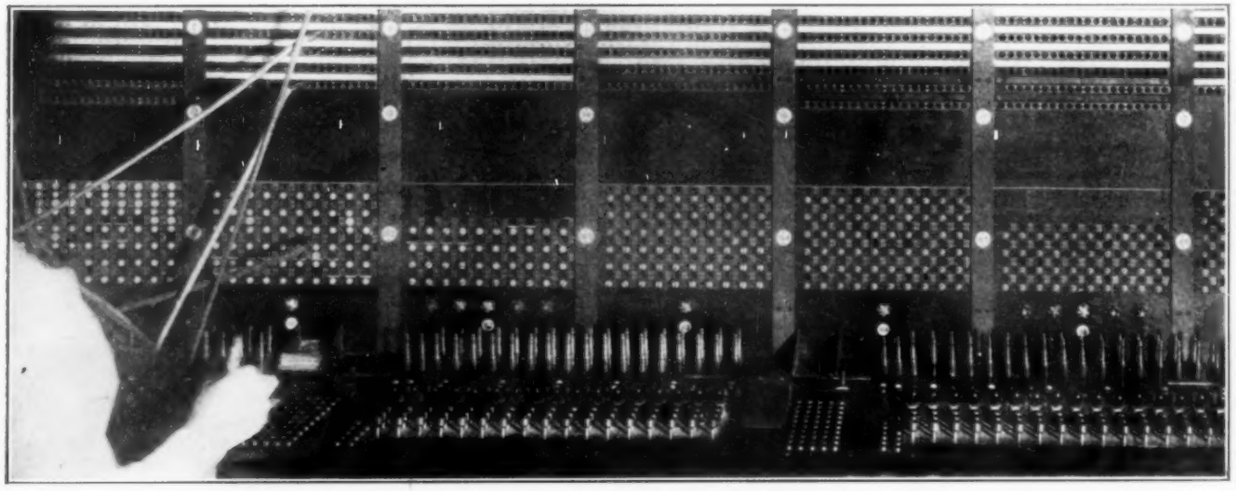
To produce a lamp that will give service for the greatest length of time has been the object of much of the development of types. To determine to what extent this has been accomplished, some interesting tests have been carried on at the Hawthorne plant of the Western Electric Company. The lamps under test were those which have been adopted as standard by the Bell telephone and other operating companies.

Life tests regularly carried on by this company show that the lamps have an extremely long life when burned at usual voltages. In fact, the usual 1,000 hour life tests show very few unsatisfactory lamps. In order to determine how long these lamps would burn, one of the test lots has been allowed to burn continuously since 1903. No change from the original condition of the lamps, so far as a satisfactory signal is concerned, has occurred during the more than 50,000 hours in which the lamps have burned. Intermittent lighting up of the lamp, similar to that given in switchboard service, in no way shortens the life of the lamp, even when the flashing has occurred for over a million times.

The wonderful results in quality which have been secured have been possible on account of a large output in product, permitting special machines and processes to be used to advantage. The capacity of the switchboard lamp factories of this one company now permits of a yearly output of two million lamps.

The early switchboard lamps which replaced mechanical signals were for low voltages and took a much higher current than is now considered standard. The development of the modern telephone lamp started with a miniature screw base type identical, except as to size, with the standard Edison base carbon lamp. The next step was to do away with the screw base and add flat, narrow strips on each side of a small tube. The size of the lamps early became fixed with dimensions of 5-16 inch in diameter and 1¾ inch long, and up to the present time very little development has been made along the lines of a smaller switchboard lamp, the great tendency being toward higher voltages and lower currents.

The standard line lamp today is designed to give a satisfactory signal on 24 volts, with a current consumption slightly less than one-tenth of an ampere. The regular sixteen candle power carbon filament lamp has a resistance when hot of approximately 220 ohms, and is placed in a comparatively large globe. The problem of placing a filament with a resistance of 250 ohms or more in a glass globe ¾ inch in diameter was well nigh impossible in the early days, but by improved methods in manufacture filaments with this resistance or even as high as 1,000 ohms can readily be placed within the standard



Lamp Signal Equipment of an Up-to-Date Multiple Switchboard, Madison Square Exchange, New York.

dimensions of switchboard lamps of the line signal type.

Inasmuch as the switchboard lamps are placed in position so that the useful light passes out through the end of the globe, it was early considered desirable to omit the usual tip on account of the absorption of the light by the thickened glass. After much development lamps were produced with rounded ends whereby the end illumination was maximum, and where the watts have been reduced to a very low figure, as in the case of some special lamps, this feature has proved of very great value. The necessary developments affect each part of the lamp manufacture, and by the means of highly specialized machines each part of the lamp is made as nearly perfect as skill and ingenuity can make it. The most important part of the lamp is ordinarily considered to be the filament. The making of the filament is a delicate process, requiring great skill and careful attention.

PREPARING THE CARBON FILAMENT.

The special small filaments for the switchboard lamps were developed at the time when the carbon filament was the only practical one on the market, and the voltages and currents adopted as standard by the telephone engineers were particularly adapted to the carbon filament. The metal filament, such as tungsten or tantalum, being of much lower resistance than the carbon, does not make ideal filaments for the voltages and currents now considered standard for telephone work. Accordingly the development of the filament was along the lines considered standard for carbon filament, and the following description shows the general methods used.

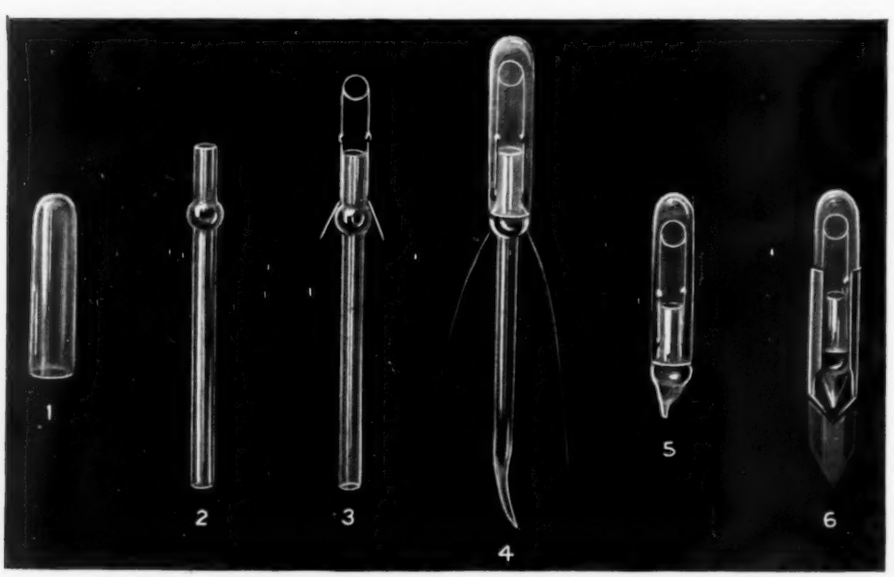
The chemist takes cotton or filter paper and dissolves it in a strong solution of zinc chloride, which happens to be one of the most corrosive and one of the most troublesome liquids that we have. This is ordinarily used in soldering by tinners, and no one would guess that within its power lay concealed the secret of the first step in the manufacture of filaments. When the paper or carbon is dissolved in the zinc chloride the result is a solution very similar in appearance to glucose, but it is full of little air bubbles every one of which must be removed or the filament will not be satisfactory.

Cotton or filter paper is ordinarily called in a lamp factory cellulose, and these are two very pure forms of this peculiar material. After it has been dissolved in the zinc chloride it is called amyloid, and when it is squirted through a small die or tube into the alcohol it forms a beautiful thread, not so very strong, but of wonderful properties. The alcohol removes the zinc chloride, precipitates and hardens the cellulose. It is similar to the general process of making artificial silk or mercerized cotton often sold as silk. The filament is squirted into a large round glass jar and many feet are squirted into the form of a ring on the bottom of the glass jar.

As the filament is squirted the ring increases in height until there are at times thousands of feet of the filament in each jar. It is a difficult problem to remove this filament, dry and stretch it without tangling. Amyloid in this form has the property of shrinking almost indefinitely in every direction, and in order to make it suitable as to uniformity in lamps careful drying must be adopted. The average size of your hair is about .002 inch in diameter, and this is just the size of the filament thread after being dried and stretched. Only girls who have perfect eyesight and delicate hands can handle this work at all satisfactorily, and even then the difficulty is great.

This thread looks very much like a violin string, although it is nowhere nearly as strong, and it is wound in suitable shape on carbon blocks preparatory to changing the cellulose thread to a pure carbon filament. The little blocks of carbon with their load of threads properly attached are then placed in a brass moulder's graphite crucible and packed thoroughly with pure powdered carbon. The cover of the crucible is securely fastened on and the crucible is placed in a gas or oil furnace, the temperature of which must reach the maximum that the crucible will stand.

The little filament, being away from all air, changes over to carbon of a most durable kind, very hard and elastic. These filaments are as pure carbon as any diamond, and are worth, in proportion to their weights, twice as much as the average diamond which you may find. They must be tested for quality, resistance and size before being sent to the operators who mount the filaments on the stems. It is a wonderfully delicate operation to handle and test filaments one-half to three-quarters of an inch long, and as thick as the hair on your head.



(1) Lamp Cap, (2) Lamp Stem Unmounted, (3) Lamp Stem with Filament Complete, (4) Lamp After Pumping, (5) Lamp Ready for Terminal, (6) Finished Product.

The electrical resistance of the lamps must be within the predetermined limits, and the uniformity of filaments from end to end must be perfect. Thousands of lamps are being made every month by the Western Electric Company having a cross section of one-quarter that of the standard filament. It is almost impossible to see these filaments with the naked eye, unless in a strong light. By great ingenuity

and expert workmanship it has been found possible to make a curled filament, that is, having a loop in it of over 1,000 ohms resistance when hot, and still be able to place it in the standard size miniature lamp having a globe of one-quarter of an inch in diameter. This lamp gives a satisfactory signal or illumination with 35 milliamperes of current and gives a satisfactory life on 48 volts, although it is usually operated anywhere from 35 volts to the maximum.

The filament, whether of the large or small size, must have its resistance within the limits allowed by the telephone companies, and in order to make the filament within the proper range and to secure a satisfactory service for a long life it is necessary to burn each filament in a vapor of gasoline or other hydro-carbon. When the filament becomes quite hot in the presence of a hydro-carbon vapor the gasoline is decomposed and a very thin coating of fine carbon or graphite is deposited on the red hot filament. This reduces the resistance of the filament to the proper amount and in addition improves its light-giving quality and durability.

THE LAMP BULBS.

It is next necessary to protect the filament from oxygen and other gases so as to preserve it unchanged throughout a long life. The lamp globe is nothing but a high quality glass tube rounded on the front end and one-quarter of an inch in diameter. This lamp globe is about one inch in length, and the stem, on which has been mounted the filament, is inserted in the open end and sealed so that it is air tight along the outside portion of the stem. The air is later exhausted through the small hole in the center of the stem and closed up tight so as to prevent the air getting back into the lamp.

THE MOUNT, OR STEM.

At the same time that the lamp globe is being made from the one-quarter inch tube the stem is being prepared from one-eighth inch tubing. The mounting wires where they pass through the glass globe are made of pure platinum, more valuable than gold, and the only metal so far discovered which does not oxidize in the ordinary gas flame and which expands and contracts at the same rate as glass. In order to secure the greatest efficiency from the light of the filament it was early decided to make the front of the lamp globe rounded and exhaust through the hollow stem so that the end candle power or illumination from the small lamps would be maximum. This design was decided upon in spite of the fact that an extra amount of platinum was necessary. The filament is fastened to the mount or stem wires by means of a carbon cement. This cement must be of such a character that it will not retain gases which may be occluded within its surface or given off from any binder which may hold the carbon together.

Many switchboard lamps have failed entirely owing to the fact that the gases from the carbon paste gradually came out of the paste and reduced the quality of the vacuum to such an extent that the lamps burned out or became too dim for a satisfactory signal.

PRODUCING THE VACUUM.

There are two standard ways of pumping an incandescent lamp—one being with mercury vacuum pumps and the other being the mechanical vacuum pump with the use of red phosphorus for the final removal of the oxygen. The mercury pumps have been discarded for many years by the large incandescent lamp manufacturers but for the miniature lamp some manufacturers still retain them in spite of their delicate design and expensive maintenance. By whatever means the lamps are pumped it is necessary that a nearly perfect vacuum shall be produced. In addition any gases which may be retained by the carbon cement which holds the filament to the mounting wires must be removed, and owing to the peculiarities of the switchboard lamp it has been found very difficult to remove the last trace of gas from the carbon paste, as it is very difficult to heat the pasted joint hot enough to drive off the gases in the process of pumping.

The quality of the vacuum in an ordinary incandescent lamp is not nearly so high as that required in a satisfactory switchboard lamp. This is due to the fact that the filament is so close to the walls of the lamp that the heat insulating quality of the vacuum must be well nigh perfect in order to prevent the heat from the filament rapidly passing into the air through a poor quality vacuum. When the quality of the vacuum is reduced only the slightest amount the temperature of the filament is decreased and the signal greatly impaired on account of the heat escaping too rapidly. The vacuum must also be very nearly perfect so that the extremely small diameter filament will not be burnt by any trace of oxygen remaining.

THE FINAL TESTS.

After the lamps have been exhausted and the usual terminals attached they are given a very thorough inspection for possible defects. Tests must be made in a few hours which in a way represent the actual operating condition of the lamp in service, and it is possible to tell in advance whether the lamps will be satisfactory when placed in the switchboard. As a defect in any part of the lamp may cause failure in the final product very great precautions have been taken to perfect every portion so that the lamps will have the utmost reliability. How well this has been done may be judged from the fact that the great majority of the lamps will burn many thousands of hours before burning out, and that the uniformity of candle power is all that is necessary for the class of service required.

Joint Pole Lines

At the third annual meeting of the Engineering Society of Wisconsin, recently held at Madison, O. M. Rau, chief electrician of the Milwaukee Electric Railway and Light Company, read a paper entitled "Use and Maintenance of Joint-Pole Lines by Public-Service Company." Mr. Rau pointed out that the existence of public service commission has an important bearing on the question of joint-pole lines, as the general tendency of the commission is toward the elimination of competition, which tendency will doubtless result in one telephone company, one electric service company and one railway company in a community, with a possible consolidation of the last two. The writer pointed out a standard method which might be adopted between different companies for joint-pole ownership and maintenance. Regarding the relative position of the different wires the high-tension lines should be at the top. The points argued in favor of joint-pole lines were: Saving in initial cost of construction; saving in maintenance; avoiding ill will of the public and improing the appearance of the streets. The subject is one to which Mr. Rau has given considerable attention and he has succeeded in bringing about a number of important combinations of this character.

Public Relations and Rates

By William Dunton Kerr*

1. TELEPHONE RATE IN NATURE OF TAX.

TELEPHONE service is a public service. A telephone company performs a public function. It is a quasi-public corporation. The state might itself, if it desired, furnish telephone service directly to the public. In many countries this is done, but here the state authorizes private corporations to furnish the service. The function of such enterprises is none the less governmental because owned and controlled by individual members of the public acting in their private capacities.

Rates Distribute Service Burdens.—Telephone rates provide the means wherewith telephone service is furnished. They enable the companies to perform their public functions. They serve the same purposes as assessments levied by the state for the support of other governmental functions undertaken directly by the public. Many cities have their own water departments which construct, operate and maintain water works and furnish water service. The expenses of such departments are met by assessments levied upon water users, known as water assessments or taxes. Other cities allow private companies to furnish water service. The rates charged by the companies fill exactly the same purposes as the taxes assessed by the cities directly when they own and operate their water facilities. In many particulars charges for public services are nothing but special assessments levied upon the individuals directly benefited to defray the cost of the services. The purpose of special assessments is to distribute the burdens of particular public improvements among those benefited substantially in accordance with the benefits received by each. In like manner it is the function of the rate schedule of a telephone utility to distribute the burdens of the service according to the benefits received by individual patrons. This is a rule of equality founded on the public character of the service. It is the first duty of government to do substantial equality to all citizens; it is no less the duty of a private company performing a governmental function. This duty can be performed only by a proper adjustment of rate schedules. The rate may properly be regarded as the agency for the distribution of service burdens according to the incidence of benefits.

2. MEASURING BENEFITS OF THE SERVICE.

Two Ways to Measure Benefits.—The benefits of telephone service may be measured by the value of the service to consumers or by the cost of the service to producers. The first method has commonly been employed by public service companies of all kinds up to within comparatively recent years. The second method is a distinctly modern innovation.

Value to Consumers.—The value of the service to the consumer is not a satisfactory test of the character of rate adjustments. Telephone service is invaluable to many consumers. To the community at large there is no possible means for measuring its value. It is futile to discuss the value to a citizen of the governmental agencies of city, state or nation which have been provided for his benefit. Such agencies are primary conceptions of an organized state of society, being essential to its very existence. Take away the telephone service and conditions bordering on chaos would result in the business, social and political world. Telephone service is public service. The telephone company is a quasi-governmental agency. To attempt to place an adequate value upon such service from the standpoint of the user is to attempt the impossible. The maximum price which an individual is able or willing to pay for telephone service is no measure of its value to him. It may measure the direct, pecuniary return which he anticipates will result from his use of the service, or the expenditure which he feels himself justified to make for an unnecessary convenience. It can never measure the multitude of social, economic, political and ethical values inherent in the telephone service. Refusal to pay more than a certain sum for a public service indicates the value of the service not so much as the willingness of the individual to deny himself inestimable benefits incapable of direct, pecuniary admeasurement. It is to the public interest to reduce to a minimum indulgence in such self-denial.

Value to Consumer Uncertain.—Value of service to consumers as a basis of rate adjustment implies charging what the service will bear. This does not mean all that the service will bear, but rates which, under all the circumstances, appear to permit the freest possible use of the service consistent with fair returns to proprietors. Many gross inequalities have been suffered to exist in the name of this principle of ratemaking. It is unsatisfactory because it is uncertain. Slight differences in angles of vision effect marked changes in rate schedules. It affords little foundation in fact for the adjustment of rates. It rests rather in the opinions and judgments of those who are responsible for the service. It has led frequently to extortion and gross abuse of public franchises. So inadequate has it come to be regarded that in some public services it has been partly or wholly supplanted by definite and fixed rules capable of general interpretation and application and founded on a public service rate factor of general utility, the cost of the service to the producer.

Cost to Producer.—In performing a public service the proprietors of a telephone company become public agencies. As such they are not entitled to all the emoluments that they are able to extract from the public. The burden may not properly be placed upon the public to show that charges are unreasonable and extortionate. The presumption, if any is to be indulged, is the other way. Rather should the burden be upon the proprietors of the service to satisfy the public by good and sufficient proof that they are not exacting greater returns than the circumstances justify. What they are clearly entitled to is that they be saved harmless from loss and be assured a substantial return sufficient to reward them for engaging capital in the public service and accepting the risks of the public service. This amount, and this amount alone, measures the responsibility of the public to the proprietors of a telephone enterprise. It is the

*Part III of a paper entitled "Public Relations of Telephone Companies," read at the Fourteenth Annual Convention of the National Independent Telephone Association. Copyright, 1911, by Wm. D. Kerr.

amount which the proprietors are entitled to and should insist upon receiving. The cost of the service, in the aggregate determines the aggregate amount to which the proprietors are entitled. In like manner, the cost of individual services is the only proper measure of the responsibilities to the proprietors of the individual beneficiaries of the service.

Costs Include All Expenses Properly Incurred.—The cost of the service includes all expenses incurred in being prepared to serve and in serving the public in the capacity of a telephone utilty. Expenses which are deferred and are not met until a later day are as much a part of the cost as expenses which are paid immediately. The wasting of assets which is invisible to the eye, which does not yield itself to definite ascertainment by the accountant, and which the engineer cannot specifically designate, is just as surely a part of the service costs as the known exhaustion of human and inert energy in the daily operations of the plant. Service costs embrace not only current operation and maintenance expenses, but taxes, depreciation, necessary reserve appropriations, and, of equal importance with any, the profit or return to which the proprietors are entitled. It is this aggregate cost which constitutes the burdens of the service. This is the sum total in every case which it is the duty of the rate schedule to distribute equitably among the beneficiaries of the service.

3. SERVICE COST FACTORS.

Nature of Cost Factors.—Rate adjustment is the problem of distributing fairly and equitably the burdens of the service among different classes of consumers. It requires a thorough understanding of the nature and character of the service costs and of the cost factors which determine their amount. These factors are of two kinds, the first having to do with the readiness to serve aspect of the service and the second pertaining to the use actually made of the service. The burden assumed by the telephone company in behalf of individual patrons may be measured by the number of the respective cost factors specifically ascribable to them. The relative benefits derived from the aggregate service by the different classes of patrons may be measured by the number of the different cost factors for which each class is responsible. Rate adjustment requires the determination of these cost factors and the distribution of the resulting service costs among the classes of patrons in accordance with the origin of the cost factors.

Readiness to Serve Factors.—The telephone service is peculiar from other public service enterprises in that a relatively large quantity of plant and equipment is devoted to the exclusive use of particular patrons, regardless of the use made or expected to be made thereof. In the gas, water and electric utilities the facilities for distribution are used jointly by large numbers of consumers and no facilities are provided for use on consumers' premises. In the telephone utility the distribution facilities are from the very nature of the service personal to particular subscribers. Moreover, extensive facilities are installed by telephone companies on the premises of consumers for their exclusive use. The service costs incurred in providing these facilities are in no manner connected with their use. They include necessary inspection, maintenance and return on investment. For that part of the facilities lying between the central office and consumers' premises the line, or talking circuit, is an important cost factor. Distance has a material bearing on wire plant costs. While the policy of American municipalities and municipal utilities may be to disregard the distance factor in rate-making, there is a strong justification for giving effect to it in the telephone business wherever possible. The costs pertaining to the facilities provided for the exclusive use of patrons on their premises may be measured to advantage by the station, or number of stations, due account being taken of differences in the character of substation equipment provided for particular individuals and classes of subscribers. The distinction between wire plant cost factors and substation cost factors is important in all cases. Lines and stations should not be confused, nor their use interchanged. A given talking circuit may have numerous stations connected thereto. The facilities of a single line may be shared by a limited number of subscribers, each with a single main line station and one or more extension stations. The practical exclusiveness of lines and stations is maintained in all such cases, but the number of lines does not represent the number of stations, nor vice versa. Some of the service costs not affected by use are dependent more particularly upon the number of subscribers than upon either lines or stations. Collection expenses are of this nature, and there may be others. The subscribers may in some cases be an important non-use cost factor.

Service Rendered Cost Factors.—The service costs which are dependent upon us have their origin in the volume and character of the use. Volume of use is measured ordinarily by the number of calls originated by particular stations or subscribers. A considerable portion, to say the least, of the use costs may be distributed on the basis of the call as a cost factor. A more satisfactory cost factor might be one combining the quantity element of use with the element of time consumed by use. A telephone circuit can accommodate only one call at one time. Still a more important cost factor is one that will represent the period of time during which the use occurs. The business of the telephone plant tends to concentrate in a few hours of the day, thus requiring extraordinary facilities for its care and attention. The contribution of different subscribers and classes of subscribers to the resulting peak load burden is capable of measurement and should be measured. This, however, is at present one of the unsolved problems. The number of calls originated is currently considered the standard of measuring use costs, recourse being had to the fiction that relative numbers of calls measure the relative contributions of different classes of subscribers to the peak load burden.

Costs Not Influenced by Service Cost Factors.—Certain service costs bear no necessary relation to any one of the cost factors named. General expenses are incurred in behalf of the business as an entirety. Return on investment and taxes are not measurable by any of the service cost factors. Costs of this character must be distributed over the groups represented by the service cost factors on bases which represent as nearly as may be the benefits derived therefrom by the direct service operations. This is altogether feasible. It involves the application of principles which are in successful use for rate-making and price-fixing by both public service and private enterprises.

4. APPLICATION OF COST SYSTEM.

Experience with Cost System Ratemaking.—In only one large city of the country is a schedule of rates known to have been compiled on a cost basis and adopted. This is Boston. Sufficient time has not yet elapsed to dem-

onstrate the effect of the cost adjustment. The principles briefly outlined herein were applied in substance to an analysis of Chicago telephone rates in 1910, and the city is at present concluding a readjustment of telephone rates strictly on a cost basis. The cost system of rate-making seems destined to receive wide application both to exchange rates and to toll rates. This analysis of the subject has concerned itself primarily with exchange service rates. The same principles are believed to be applicable to toll service rates. Such application might effect material changes in the volume and character of toll service over moderate distances, adding to the public use of the facilities for such service and to the productiveness thereof to operating companies.

Limit of Utility.—The cost system of rate adjustment is valuable not as an end in itself but because it contributes to a desirable end. The great effort in public utility ratemaking is to distribute the burdens of the service according to the distribution of its benefits. In special cases it may not be advsable to adhere closely to an adjustment on a rigid cost basis. It may be preferable under all the circumstances to impose upon certain classes of users parts of the burdens that properly belong to other classes. But when this is done it should be done knowingly and understandingly. Because of the lack of diversity in service requirements a cost system may be dispensed with in ratemaking for small exchanges, but the moment any marked diversity appears a cost system of adjustment becomes valuable. Rates adjusted on a cost basis should result in the fullest and freest possible use of the service. Every unit of service supplied is compensated for, and the company may strive earnestly for the full development of every class. The company gains by the certainty of returns and the elimination of risks and the public gains by the wide extension of the service and the substantial equality which result.

New York Commission News

The New York Public Service Commission, second district, has received a complaint from the Oneida Chamber of Commerce directed against the New York Telephone Company as to the rates charged in the city of Oneida. It is alleged that prior to January 1, 1911, the rates charged by the New York Telephone Company and its predecessor, the Central New York Company, provided for direct line business service, $24 to $36 per year, two-party residence service, $15 per year, two-party business service, $24 to $30 per year, and that the rates now in effect provide for a charge of $36 for direct line residence service, $42 for direct line business service, $30 for two-party residence service, $36 for two-party business service, $30 for two-party residence service, $36 for two-party business service, $16 for four-party residence service, and $24 for four-party business service. The complaint alleges that the rates now charged are excessive, unreasonable, unjust and unlawful and in excess of the rates charged by the same company for substantially the same service in other localities of the size and situation which obtains in Oneida. The complaint alleges that representatives of the company are securing signatures to contracts and threatening in case of refusal to sign that telephones will be taken out of residences and business places. It is stated that before the formal complaint was filed, committees of the Board of Trustees negotiated with the New York Telephone Company with the hope that rates might be reduced, but without result; further, that the company has been asked to present to a committee of the Chamber of Commerce a statement showing its investments in the plant at Oneida and its cost of operation, so that it might be ascertained whether the charges now in effect are reasonable, and the company has refused to present such statement.

The commission is taking testimony on the application of the Federal Telephone and Telegraph Company of Buffalo for authority to issue bonds to the amount of $653,800 and stock of the par value of $174,250, with the proceeds of which it proposes to take over outstanding securities of independent telephone companies in Niagara Falls, Lockport, Tonawanda, Medina, Dunkirk, Batavia, and the company now serving localities in Wyoming county. It also proposes to acquire pole lines running from Erie, Pa., to Canandaigua, and lines through the western section of New York state, connecting these points.

The Federal company now has contracts which will insure the transfer of all the securities in question if the commission approves the application. The company was represented by Edward H. Letchworth of Buffalo and Howard Hendrickson of Albany. Several officers and employes of the company testified as to the value and condition of the properties.

The Federal company has also applied to the commission for permission to transfer to it franchises held by the Warner Telephone Company of Gowanda, the Penn Yan Telephone Company, the Wayland Independent Telephone Company, the Clifton Springs Telephone Company, the Livingston County Telephone Company operating at Avon, Caledonia, Dansville, Geneseo, Honeoye Falls, Lima and Livonia, and the Salamanca Telephone and Telegraph Company. The Federal company now owns all the capital stock of these companies and wishes to take over the franchises and merge each with the Federal company.

It is stated that the applications before the commission are made for the purpose of increasing the effectiveness of the independent telephone business upstate, bringing the properties into closer relationship and effecting economies in operation.

Independent Lines to Enter Chicago

Through an order issued in the United States Circuit Court a traffic agreement is effected between the Illinois Tunnel Company and the Interstate Telephone and Telegraph Company, whose lines surround the city, and an entrance is secured to Chicago by the independent companies.

The ruling of Judge Kohlsaat means that the city will get long distance independent telephone connection with St. Louis and other cities in at least nine different states. The number of cities and towns reached in the state of Illinois alone by the Interstate Company is 1,234.

This concern operates 1,567 miles of toll lines in central and northern Illinois. The main trunk line connects Springfield, Peoria, Joliet, Elgin and Aurora. The trunk line west from Aurora gives direct connection with Sterling, Ill.; Clinton, Ia., and other points.

Two different lines enter Cook county, one for the exchange at Orland and the other directly to the city limits at Forty-sixth avenue and West Twenty-second street.

DEPARTMENT of RAILWAY TELEPHONES

Railway Telephones in the United States

Report of the Interstate Commerce Commission

JUNE, 1910, we published the report of the Interstate Commerce Commission of the previous year on the use of the telephone for transmission of train orders on the railroads of the United States. The data was compiled by the Block Signal and Train Control Board.

On the following pages is presented the report for the last year on the same subject, namely: railroads in the United States on which the telegraph and the telephone are used for the transmission of train dispatchers' orders which confer, restrict, or change the road rights of trains. It will be understood that this list has no bearing on the block-signal lists. This list includes those electric trolley roads which report to the commission. As the figures indicate, there are sections of line on which both the telegraph and the telephone are used, and there are other sections of line on which neither the telegraph nor the telephone is used for transmission of train orders.

Total railway telephone mileage as given last year was 26,344. This year's total of 41,717 gives an apparent gain of 15,373. In the present list, however, appear those electric railways which, by reason of their interstate operation, come under the jurisdiction of the commission. These electric roads, all operated by telephone, have a total mileage of 3,605. Since they were not included in last year's list, this amount must be deducted to show the net gain for steam railroads. The result shows a steam railroad telephone mileage, as of January 1, 1911, of 38,112, and a consequent net gain for the year of 11,768 miles, or approximately 45 per cent. This is a remarkable development for twelve months, and shows better than all argument the soundness of the telephone method of train handling.

This list has no bearing on the operation of block signals, in which work telegraph, telephone and electric bells are used. Except on lines of very light traffic, train dispatchers' orders are constantly required in connection with the movement of trains, whether the block system is or is not used. On a line where it is not used, however, the function of the train order is relatively more important.

Without the block system a train order may be, and usually is, a vital factor in the safe movement of trains affected by it. With the block system, the block signals providing the required safeguard against collision, the function of the train order may be one of convenience or celerity only.

The remarkable increase in the use of the telephone by railways during the year is especially striking when we realize that there are still railroad men of authority who remain unconvinced of its efficiency.

In spite of the increase, there still remains some 173,286 miles of interstate railroad unequipped with telephones—over four times as much as has already equipped. There is obviously plenty of opportunity here for the makers of telephone apparatus. Indeed, the present annual *increase* in total railroad mileage is much greater than the total number of miles now equipped with telephones.

In the following list the names marked with asterisks (*) are electric railroads doing interstate business.

In the section published last year, telegraph statistics were not given, only the number of telephone miles.

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical developments, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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Names of railroads.	Telegraph miles.	Telephone miles.	Total operated miles.
Ahnapee & Western	34	....	34
Albany Southern	36	36	36
Alton, Granite & St. Louis*	....	55	55
Ann Arbor	291	2	293
Arizona & New Mexico	108	108	108
Arizona Southern	20	20	20
Arkansas Central	46	....	46
Arkansas Western	....	32	32
Atchinson, Topeka & Santa Fe	5,448	3,884	9,332
Atlanta & West Point	6	....	93
Atlanta, Birmingham & Atlantic	662	....	662
Atlantic & Western	....	9	9
Atlantic Coast Line	3,672	376	4,048
Attleboro Branch	....	4	4
Au Sable & Northwestern	....	67	67
Baltimore & Ohio	3,030	21	3,051
Baltimore & Ohio Chicago Terminal	76	....	76
Baltimore & Ohio Southwestern	409	....	409
Baltimore & Sparrow's Point	....	5	5
Baltimore, Chesapeake & Atlantic	87	....	87
Bangor & Aroostook	622	....	622
Bellingham Bay & British Columbia	....	49	49
Bennettsville & Cheraw	....	34	34
Bessemer & Lake Erie	118	77	201
Big Fork & International Falls	34	....	34
Big Sandy & Cumberland	....	24	24
Bloomsburg & Sullivan	29	....	29
Blue Ridge	44	....	44
Boston & Maine	1,994	232	2,239
Boise & Interurban*	....	29	29
Boyne City, Gaylord & Alpena	....	93	93
Brockton & Plymouth*	....	23	23
Buffalo & Lake Erie*	....	101	101
Buffalo & Susquehanna	321	13	334
Buffalo, Attica & Arcade	26	....	26
Buffalo, Rochester & Pittsburg	430	....	430
Bullfrog-Goldfield	82	....	82
Butler County	9	....	9
Butte, Anaconda & Pacific	47	....	47
Butte County	32	....	32
Carolina & Northwestern	12	3	134
Central Indiana	127	....	127
Central of Georgia	1,916	....	1,916
Central New England	275	....	275
Central R. R. of New Jersey	505	....	505
Charlotte, Monroe & Columbia	....	18	18
Chesapeake & Ohio	1,323	69	1,392
Chesapeake & Ohio Ry. of Indiana	269	....	269
Chesapeake Beach	28	....	28
Chesapeake Western	40	40	40
Chestnut Ridge	....	10	10
Chicago & Alton	991	19	1,010
Chicago & Eastern Illinois	693	....	693
Chicago & Illinois Midland	25	....	25
Chicago & Illinois Western	11	....	11
Chicago & Milwaukee*	....	86	86
Chicago & North Western	7,003	743	7,746
Chicago & Western Indiana	27	....	27
Chicago, Burlington & Quincy	6,439	2,383	9,040
Chicago Great Western	1,478	....	1,478
Chicago, Harvard & Geneva Lake	....	13	13
Chicago, Indianapolis & Louisville	578	....	578
Chicago, Milwaukee & Gary	120	....	120
Chicago, Milwaukee & St. Paul	6,233	1,044	7,277
Chicago, Milwaukee & Puget Sound	1,077	726	1,803
Chicago, Peoria & St. Louis Ry. of Illinois	235	....	235
Chicago, Rock Island & Pacific	4,674	2,248	6,922
Chicago, Rock Island & Gulf	469	....	469
Chicago, St. Paul, Minneapolis & Omaha	1,674	....	1,674
Chicago, South Bend & Northern Indiana	....	67	67
Cincinnati, Georgetown & Portsmouth	....	53	53
Cincinnati, Hamilton & Dayton	608	....	608
Cincinnati, Indianapolis & Western	361	....	361
Cincinnati, Lawrenceburg & Aurora*	....	32	32
Cincinnati, Lebanon & Northern	44	....	44
Cleveland & Erie*	....	33	33
Coal & Coke	198	198	198
Colfax Northern	....	13	13
Colorado & Southern	1,016	....	1,016
Colorado & Wyoming	51	6	51
Colorado Midland	243	....	258
Colorado Springs & Cripple Creek District	51	....	51
Columbia & Puget Sound	51	....	51
Columbia, Newberry & Laurens	75	....	75
Copper Range	77	....	77
Cornwall	13	....	13
Coudersport & Port Allegany	39	....	39
Crystal River	17	....	17
Cumberland & Pennsylvania	31	....	31
Cumberland Valley	....	162	162
Dansville & Mount Morris	15	....	15
Davenport, Rock Island & Northwestern	42	....	42
Dayton & Union	32	....	32
Dayton, Covington & Piqua Traction*	....	31	31
Delaware & Hudson	798	....	798
Delaware, Lackawanna & Western	916	....	916
Denison & Pacific Suburban	7	....	7
Denver & Rio Grande	2,352	32	2,384
Rio Grande Southern	169	....	169
Denver, Boulder & Western	46	....	46
Denver, Northwestern & Pacific	214	....	214
Des Moines Union	5	....	5
Detroit & Clarlevoix	....	44	44
Detroit, Jackson & Chicago*	....	96	96
Detroit, Monroe & Toledo Short Line*	....	52	52
Detroit, Toledo & Ironton	339	....	339
Detroit United	....	135	135
Duluth & Iron Range	168	....	168
Duluth & Northeastern	....	56	56
Duluth, Missabe & Northern	167	9	176
Duluth, South Shore & Atlantic	588	....	588
Durham & Southern	56	56	56
East Broad Top R. R. & Coal Co	46	46	46
East Carolina	38	38	38
Eastern Kentucky	36	....	36
East St. Louis & Suburban*	....	57	57
East Jordan & Southern	....	19	19
Elgin, Joliet & Eastern	205	8	213
Erie	1,981	175	2,156
Bath & Hammondsport	....	10	10
Columbus & Erie	13	....	13
Erie & Jersey	39	....	39
New Jersey & New York	38	....	38
New York, Susquehanna & Western	233	....	233
Erie & Michigan Ry. & Navigation Co	....	8	8
Escanaba & Lake Superior	80	....	80
Eureka & Palisade	88	....	88
Evansville & Indianapolis	146	....	146
Evansville & Southern Indiana	....	33	33
Evansville & Terre Haute	56	109	175
Farmers' Grain & Shipping Co	66	....	66
Florence & Cripple Creek	40	....	40
Florida East Coast	570	....	570
Fonda, Johnstown & Gloversville	36	....	36
Fort Dodge, Des Moines & Southern*	....	159	159
Fort Smith & Western	217	....	217
Fort Wayne & Springfield*	....	22	22
Fort Wayne & Wabash Valley Traction*	....	139	139
Fort Worth & Denver City	454	....	454
Fort Worth & Rio Grande	196	....	196
Galveston, Houston & Henderson	47	....	47
Genesee & Wyoming	16	....	16
Georgia	58	245	303
Georgia Coast & Piedmont	82	....	82
Georgia Southern & Florida	396	....	396
Georgia Southwestern & Gulf	35	....	35
Georgia, Florida & Alabama	194	....	194
Grand Rapids, Grand Haven & Muskegon*	....	41	41
Grand Trunk	1,122	....	1,122
Great Falls & Old Dominion*	....	28	28
Great Northern	3,224	3,881	6,905
Green Bay & Western	225	....	225
Hazelhurst & Southeastern	8	16	24
Hillsboro & Northeastern	....	5	5
Hocking Valley	337	....	337
Houston & Brazos Valley	....	20	20
Huntingdon & Broad Top Mountain R. R. & Coal Co.	....	53	71
Illinois Central	2,531	2,550	4,581
Yazoo & Mississippi Valley	1,371	....	1,371
Illinois Terminal	15	....	15
Illinois Traction*	....	415	415
Indianapolis & Louisville Traction*	....	41	41
Indianapolis, Crawfordsville & Western Traction*	....	45	45
Indiana Union Traction Co.*	....	313	313
International*	32	32	32
International & Great Northern	1,142	....	1,142
Interstate	....	27	27
Interstate Consolidated*	....	27	27
Inter-Urban*	....	59	59
Iowa & Illinois*	....	40	40
Ironton	....	9	9
Jamestown, Chautauqua & Lake Erie	33	....	33
Joplin & Pittsburg	....	98	98
Kanawha & Michigan	162	1	163
Kansas City, Clinton & Springfield	157	....	157
Kansas City Southern	827	....	827
Kansas City Terminal	11	11	11
Kansas Southwestern	60	....	60
Kennebec Central	5	5	5
Kentucky & Indiana Bridge & Railroad Co	18	....	18
Kentucky & Tennessee	....	11	11
Kentwood & Eastern	....	52	52
Kewaunee, Green Bay & Western	37	....	37
Keweenaw Central	26	....	26
Klamath Lake	....	24	24
Lackawanna & Wyoming Valley	....	23	23
LaCrosse & Southeastern	....	43	43
Lake Champlain & Moriah	....	7	7
Lake Superior & Ishpeming	19	....	19
Lake Tahoe	....	16	16
Lancaster & Chester	29	....	29
Laramie, Hahn's Peak & Pacific	1	1	55
Leavenworth & Topeka	47	....	47
Lehigh & Hudson River	73	....	73
Lehigh & New England	136	69	140
Lehigh Valley	743	643	1,386
Licking River	....	32	32
Litchfield & Madison	44	....	44
Livingstone & Southeastern	....	7	7
Long Island	392	....	392
Lorama	....	14	14
Los Angeles & Redondo	....	37	37
Los Angeles Pacific*	....	177	177
Louisiana & Arkansas	260	....	260
Louisiana & Northwest	121	....	121
Louisiana & Pacific	43	25	70
Louisiana Central	....	24	24
Louisiana Railway & Navigation	334	....	334
Louisville & Nashville	3,388	498	8,884
Louisville & Northern*	....	17	17
Louisville & Southern Indiana Traction*	....	9	9
Lowville & Beaver River	....	10	10
Macon & Birmingham	105	105	105
Macon, Dublin & Savannah	93	....	93

Names of railroads.	Telegraph miles.	Telephone miles.	Total operated miles.
Maine Central	908	....	908
Somerset	92	....	92
Washington County	138	....	138
Manchester & Oneida	....	8	8
Manistee & Grand Rapids	72	....	72
Manistee & Northeastern	182	....	182
Manitou & Pike's Peak	9	9	9
Mansfield Railway & Transportation Co.	....	16	16
Marquette & Southeastern	27	24	51
Maryland & Pennsylvania	77	....	77
Maryland, Delaware & Virginia	8	6	78
Maryland Electric*	2	27	27
Midland Terminal	29	....	29
Midland Valley	288	....	288
Milford, Attleboro & Woonsocket*	....	28	28
Minneapolis & St. Louis	998	....	998
Albia & Centerville	24	....	24
Iowa Central	503	....	503
Minneapolis, St. Paul & Sault Ste. Marie	3,518	190	3,708
Mineral Point & Northern	26	26	26
Minnesota & International	175	....	175
Mississippi Central	150	26	150
Mississippi Eastern	....	26	26
Mississippi River & Bonne Terre	53	....	53
Missouri & Illinois Bridge & Belt	3	3	3
Missouri & North Arkansas	331	....	331
Missouri, Kansas & Texas	3,006	66	3,072
Missouri Pacific	3,831	79	3,831
St. Louis, Iron Mountain & Southern	3,032	168	3,200
Missouri Southern	....	54	54
Mobile & Ohio	825	....	825
Monongahela	....	67	67
Monroe	10	....	10
Montour	11	13	13
Morenci Southern	18	18	18
Mount Jewett, Kinzua & Riterville	....	18	18
Munising	45	23	76
Muscatine North & South	39	....	39
Nacogdoches & Southeastern	....	13	13
Nashville, Chattanooga & St. Louis	1,230	....	1,230
Natchez, Columbia & Mobile	....	24	34
Nevada, California, Oregon	184	....	184
Nevada Central	93	93	93
Nevada County Narrow Gauge	....	21	21
Newburgh & South Shore	7	....	7
New Mexico Central	116	....	116
New Orleans & Northeastern	196	....	196
New Orleans Great Northern	243	....	243
New Orleans, Mobile & Chicago	397	15	412
New York & Long Branch	38	....	38
New York & Pennsylvania	....	57	57
New York, Auburn & Lansing*	....	37	37
New York Central Lines:			
Boston & Albany	88	278	336
Chicago, Indiana & Southern	110	216	326
Cincinnati Northern	206	....	206
Cleveland, Cincinnati, Chicago & St. Louis	1,145	704	1,849
Kankakee & Seneca	43	....	43
Peoria & Eastern	338	....	338
Lake Erie & Western	872	571	872
Lake Shore & Michigan Southern	793	770	1,563
Cleveland Short Line	....	10	10
Dunkirk, Allegheny Valley & Pittsburg	....	90	90
Lake Erie, Alliance & Wheeling	....	88	88
Little Falls & Dolgeville	10	4	4
Michigan Central	545	714	1,259
New York Central & Hudson River	2,388	521	2,909
New York & Ottawa	70	....	70
Peoria & Eastern	338	....	338
Rutland	416	....	416
Toledo & Ohio Central	398	....	398
Zanesville & Western	85	....	85
New York, Chicago & St. Louis	391	132	523
New York, New Haven & Hartford	1,879	184	2,063
New York, Ontario & Western	493	....	493
New York, Philadelphia & Norfolk	95	17	112
Norfolk & Portsmouth Belt	....	14	14
Norfolk & Western	752	1,066	1,867
Norfolk Southern	519	222	565
Northern Pacific	4,469	1,190	5,659
Northwestern Pacific	215	112	327
Norwood & St. Lawrence	....	18	18
Ohio Electric*	....	40	40
Ohio River & Columbus	....	24	24
Ohio Valley Electric*	....	16	16
Ohio Valley Scenic Route	....	39	39
Pacific & Idaho Northern	76	....	76
Pacific Electric*	....	503	503
Pajaro Valley Consolidated	....	42	42
Parkersburg, Marietta & Interurban*	....	19	52
Pennsylvania	1,856	1,734	3,541
Calumet Western	3	....	3
Cherry Tree & Dixonville	....	29	29
Cincinnati & Muskingum Valley	149	....	149
Cleveland, Akron & Columbus	178	....	178
Grand Rapids	578	2	580
Manufacturer's	3	....	3
Northern Central	394	59	449
Pennsylvania Co.	1,235	107	1,342
Philadelphia, Baltimore & Washington	572	122	695
Pittsburg, Cincinnati, Chicago & St. Louis	1,424	....	1,424
Vandalia	827	....	827
West Jersey & Seashore	229	84	313
Peoria & Pekin Union	15	....	15
Pere Marquette	1,515	138	1,651
Perla Northern	20	20	20
Phillipsburg Horse Car R. R.	....	4	4

Names of railroads.	Telegraph miles.	Telephone miles.	Total operated miles.
Philadelphia & Reading	934	36	989
Atlantic City	167	....	167
Catasauqua & Fogelsville	29	....	31
Chester & Delaware	3	....	5
Gettysburg & Harrisburg	39	....	42
Middletown & Hummelstown	6	....	6
North East Pennsylvania	26	....	26
Perkiomen	38	....	38
Philadelphia & Chester Valley	24	....	24
Philadelphia, Newton & New York	22	....	22
Pickering Valley	11	....	11
Port Reading	20	....	21
Reading & Columbia	59	....	59
Rupert & Bloomsburg	2	....	2
Stony Creek	10	....	10
Tamaqua, Hazleton & Northern	10	....	10
Williams Valley	3	8	11
Pickins	....	9	9
Pittsburg & Moon Run	....	5	5
Pittsburg, Lisbon & Western	25	....	25
Pittsburg, Shawmut & Northern	175	99	211
Providence & Danielson*	....	26	26
Providence & Fall River*	....	2	12
Quincy, Omaha & Kansas City and Iowa & St. Louis	305	....	305
Rapid*	....	99	99
Raritan River	17	2	19
Reynoldsville & Falls Creek	....	26	26
Richmond, Fredericksburg & Potomac	9	79	88
Rio Grande	23	....	23
Rockford & Interurban*	....	77	77
St. Joseph & Grand Island	258	....	258
St. Louis & San Francisco	4,187	835	5,022
Beaumont, Sour Lake & Western	84	....	117
New Orleans, Texas & Mexico	158	....	265
Orange & Northwestern	62	....	62
St. Louis, Brownsville & Mexico	452	....	452
St. Louis, Kennet & Southeastern	....	19	19
St. Louis Merchants' Bridge Terminal	9	....	9
St. Louis Southwestern	629	....	629
Dallas Terminal	2	....	2
Eastern Texas	30	....	31
St. Louis Southwestern of Texas	695	....	695
Shreveport Bridge & Terminal	1	....	1
Paragould Southeastern	37	....	37
Pine Bluff, Arkansas River	24	....	24
Southern Illinois & Missouri Bridge	5	....	5
Stephenville, North & South Texas	42	....	42
Salem, Falls City & Western	....	27	27
Salt Lake & Los Angeles	....	15	15
San Antonio & Aransas Pass	724	....	724
San Diego & Cuyamaca	25	....	25
Sandy River & Rangeley Lakes	....	78	78
San Pedro, Los Angeles & Salt Lake	961	....	1,073
Santa Fe, Prescott & Phoenix	364	....	364
Seaboard Air Line	2,625	421	3,046
Sibley, Lake Bisteneau & Southern	....	28	28
Sierra Valley	....	37	37
South Buffalo	....	7	7
Southern	6,916	123	7,039
Southern Indiana & Chicago Southern	343	....	343
Southern Michigan	....	35	35
Southern Pacific, Atlantic system:			
Arizona Eastern	355	320	360
Galveston, Harrisburg & San Antonio	1,247	77	1,336
Houston & Texas Central	789	....	789
Houston East & West Texas	191	....	191
Houston & Shreveport	40	....	40
Iberia & Vermilion	16	....	16
Louisiana Western	198	....	208
Morgan's Louisiana & Texas	317	....	348
Texas & New Orleans	435	....	459
Southern Pacific, Pacific system	5,245	980	6,448
South Georgia	....	77	77
Southwest Missouri*	....	73	73
Spokane & British Columbia	....	35	35
Spokane, Portland & Seattle	416	15	431
Astoria & Columbia	123	....	123
Stanley, Merrill & Phillips	....	38	38
Staten Island	13	....	13
Staten Island Rapid Transit	11	....	11
Sumpter Valley	....	62	62
Tallulah Falls	58	....	58
Tampa & Jacksonville	48	....	48
Terminal Railroad Association of St. Louis	9	....	9
Texas & Pacific	1,885	....	1,885
Texas Midland	125	....	125
Toledo & Chicago Interurban*	....	40	40
Toledo & Indiana Traction*	....	52	52
Toledo, Peoria & Western	220	....	220
Toledo, Port Clinton & Lakeside*	....	53	53
Toledo, St. Louis & Western	451	....	451
Toledo Terminal	31	....	31
Tonopah & Goldfield	98	....	98
Tonopah & Tidewater	174	....	174
Tremont & Gulf	....	124	124
Tri-State Traction*	....	8	8
Tuckerton	29	29	29
Uintah	55	....	55
Ulster & Delaware	129	....	129
Union Pacific	2,815	606	3,422
Oregon Short Line	1,512	48	1,560
Oregon Railroad & Navigation	1,337	....	1,341
Oregon & Washington	195	113	250
Ilwaco	....	29	29
Corvallis & Eastern	119	19	140

Names of railroads.	Telegraph miles.	Telephone miles.	Total operated miles.
Unadilla Valley	....	19	19
Union & Glenn Springs	....	19	19
United Verde & Pacific	26	26	26
Valley	....	11	11
Victoria, Fisher & Western	....	25	25
Virginia & Kentucky	....	5	5
Virginia & Southwestern	198	....	198
Virginia-Carolina	16	31	31
Virginian	....	467	467
Virginia Antharcite Coal & Railway Co.	....	10	10
Wabash	2,056	....	2,056
Wabash, Chester & Western	64	....	64
Wabash Pittsburg Terminal	3	61	64
Warren & Jamestown*	....	22	22
Warren & Ouachita Valley	....	16	16
Washington, Baltimore & Annapolis*	....	86	....
Washington Run	....	4	4
Washington Southern	....	32	32
Washington-Virginia	....	43	43
Waterloo, Cedar Falls & Northern	20	26	26
Waynesburg & Washington	....	28	28
Weatherford, Mineral Wells & Northwestern	42	....	42
West Chester, Kennett & Wilmington*	....	21	21
Western Maryland	543	....	543
Western Ohio*	....	111	111
West Side Belt	....	21	21
West Virginia Northern	....	11	11
Wharton & Northern	....	72	72
Wheeling & Lake Erie	522	....	522
Wheeling Terminal	5	5	10
Wheeling Traction*	....	20	20
Wichita Valley	257	....	257
Williamsport & North Branch	....	44	44
Wisconsin & Michigan	90	8	137
Wise Terminal	....	6	6
Woodstock	....	14	14
Worcester & Blackstone Valley*	....	28	28
Worcester & Southbridge*	....	58	....
Wrightsville & Tennile	108	....	108
Wyandotte & Southeastern	18	18	18
Total	175,211	41,717	215,003

Pennsylvania Railroad Telephones

The use of the telegraph has been entirely done away with in the way station towers of the Middle division of the Pennsylvania Lines East, which extends from Harrisburg to Altoona. The only telegraph business here consists of through messages between division points.

Telephone equipment is now in successful operation also over the Philadelphia division, from Philadelphia to Harrisburg. These two form what is known as

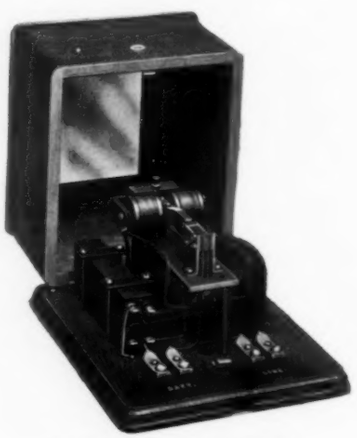
Corner of Dispatcher's Office at Harrisburg.

the Grand Eastern division. On the two sections named the telephone is now being used for dispatching, message and blocking work.

Between Harrisburg and Philadelphia a system of sending out time on the telephone wires has recently been put into effect. The system in use is one developed by the Western Electric Company, which has supplied the telephone equipment of these two divisions. It consists essentially of the installation at each way station of 1,000 ohm ringers in series with the selector, and at the dispatcher's office a transformer is arranged so that the telegraph relay which receives the time makes and breaks the primary. This causes alternating kicks to be generated in the secondary, which operates all the time bells, reproducing the taps which were formerly heard on the telegraph sounder.

The Pennsylvania has adopted for use in block towers interrupters for signalling on all the radiating lines which require code ringing. These interrupters are operated by push buttons, which close the local battery and send alternating current on the lines. The Pennsylvania was the first to use this type of interrupter and has found that by its use the operators save both time and energy in ringing on the lines.

At Harrisburg the telephone business of the Pennsylvania Railroad is handled through a central battery,



Type of Signaling Interrupter.

multiple switchboard of the newest type, with four positions, and connected with the lines of the Bell Telephone Company of Pennsylvania. Extensions reach all the offices and departments in the big station at Harrisburg and the residences in that city of many of the officials and employes. Trunk lines from this board go to Altoona and Philadelphia and to small switchboards located at important points both east and west on the railway's telephone system. A unique use of this service is made in the train shed at Harrisburg, where an usher announces trains when notified over the telephone by the station master.

Altoona, which is a busy railroad city, also uses a multiple exchange equipment of the type used in large operating offices. The fact that over 4,000 trunk calls were recorded every twenty-four hours recently led to an order for the equipment of additional trunk facilities for this exchange. The telephone is used in this city for calling employes to duty. This is a task which formerly occasioned the employment of many messenger boys. Today each railroad man has a telephone in his home connected to the central in the railroad office.

The station at Harrisburg as well as the one at Altoona is equipped with a toll test board, the use of which permits quick and accurate tests over both telephone and telegraph circuits of the railway's dispatching and message system.

Each way station is equipped with a special switchboard of the Pennsylvania Railroad Company's own design. This board contains ten combined jacks and signals, which are equipped with local contacts for code ringing. Two telephone sets are placed in each way station tower, one mounted on a special transmitter arm, the other an emergency desk stand telephone with head receiver.

Dispatching on the Central Vermont

By K. W. Endres

ONE of the most recent installations of telephone train dispatching equipment is on the Central Vermont Railway. It extends from St. Albans to Windsor, Vermont, with a branch from Montpelier Junction to Williamstown, 150 miles in all.

Over this division a heavy copper circuit of No. 9 B. & S. gauge wire, weighing 210 pounds to the mile, is strung, with transpositions located approximately at quarter-mile intervals. The wires at exposed points are brought into the stations through circular loom cable, and the construction is of first-class character throughout.

There are 38 way stations equipped with selectors and telephone sets on the division. The station equipments have been installed in a uniform manner. A typical way station is shown in the illustration, Fig. 1, which gives an excellent view of all the apparatus. A mounting board is provided, upon which are placed the selector, Argus lighting arresters, Western Electric protectors, knife switches and battery box.

The Van Akin telephone arm which is provided for the use of the operators is also clearly shown. The transmitter and receiver are mounted on a short arm which is adjustable to fit different sized heads, and when a man places his head in position to talk, his ear is naturally

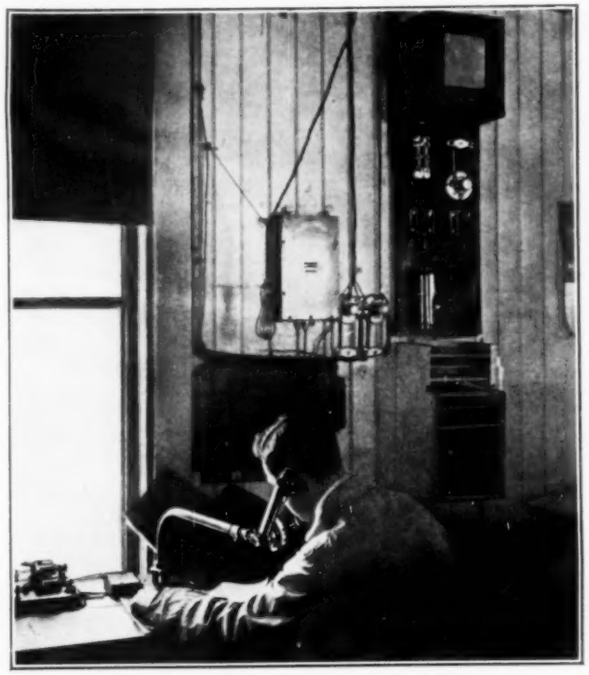


Fig. 1. Receiving Message at Way Station.

brought against the receiver. These arms have proved of exceptional value for tower work where interlocking switches must also be handled by the operator, because they permit him to get away from the telephone quickly without having to remove and hang up a head set.

The whole telephone set is included in the Van Akin arm, together with commutator switches which connect the set to the circuit when the arm is swung around to the operating position. This is located at the base of the arm under the operator's desk.

The illustration of the dispatcher's office, Fig. 2, shows clearly the calling keys arranged in their cabinet

Fig. 2. The Dispatcher at His Post.

before him, and also shows the convenient telephone set which the dispatcher wears and which is connected to the circuit by means of a plug inserted in jacks under his desk. Underneath the shelf of the desk on the left of the key cabinet is the strap key, by means of which the dispatcher controls the ringing of the bell at the way station which he has called.

Fig. 3 shows the arrangement of the terminal equipment at the dispatcher's office. This, likewise, has been mounted on a single board which is hinged for convenience in maintenance work. The retardation coils and condensers which absorb the noise of the sending battery are mounted on the upper half of the board, while switches and protectors are located at the bottom. In the left-hand corner is shown the telegraph relay by means of which the direct current impulses are sent out on the line. This relay is operated in a local circuit by means of the selector keys. Opposite this on the right-hand side of the board will be noticed five telephone keys which are arranged for cutting off various telephone loops around the St. Albans office in order to clear the circuit for testing purposes. These loops are wired to the superintendent's and chief dispatcher's desks, as well as to those of one or two other officials, and permit these officials to listen upon the circuit whenever they may desire and supervise the service being given.

The circuit at each way station is carried through knife switches so that all the simple tests usually required on a line of this character can easily be made. In addition, the Central Vermont has provided for its wreckers two portable sets of a somewhat original design. These sets are mounted in wooden boxes equipped with writing shelves and also have telephone jacks and sets similar to those employed by the dispatcher. In this way, a telephone operator is kept right at the set on the location of the accident, and does nothing but handle the orders from headquarters. The head receiver and chest transmitter are provided, of course, since the

operator will be steadily at this job, and doing nothing else. Blue Bell dry batteries are used throughout on the equipment.

All of the equipment used on this road was ordered from the Western Electric Company, which has supplied so much of this railway telephone apparatus throughout the country. It was installed by the Central Vermont Railroad under the direction of M. Magiff,

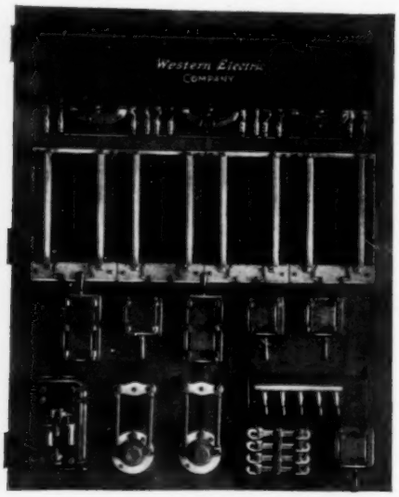


Fig. 3. Terminal Apparatus Mounted on Board.

superintendent of telegraph, and at latest reports was giving good satisfaction. The Central Vermont is the last of a number of prominent New England railroads which have adopted the telephone, and the excellent results which they are all obtaining indicate that it will not be long before the whole of New England is covered by this method of dispatching.

The Telephone in Emergency and Wreck Service

The Delaware, Lackawanna & Western Railroad, besides being fully equipped for telephone train dispatching with the United States Electric Company's Gill selective system, has also in service the portable test sets for the use of its linemen, with the extension pole, thereby telephonic communication may be secured at any point on the line. Two recent incidents well illustrate the value of the emergency service of the telephone. The experience in this line is that the time saved by the telephone as compared with the telegraph in clearing wrecks is considerable, and is appreciated, although it may be difficult to state it in figures.

One afternoon recently one of the linemen was riding on a freight train on the mountain section, about a mile and a half west of a station, when a truck under one of the cars broke, and the momentum of the train scattered six cars, blocking two of the three tracks. An east-bound fast passenger train was nearly due and several manifest trains were about to take the slow track which alone remained open.

The lineman immediately notified the dispatcher with his portable set, with the result that the manifests were detained long enough to detour the fast passenger train, and the slow track was held open until the wrecker had got alongside the spill and cleared one of the fast tracks. The superintendent estimated that the lineman's prompt action and the control of the situation by telephone had saved 60 per cent of the time required to clear the track if traffic had been permitted to congest.

In another instance an engine broke a main rod at a point three miles from the nearest station. With the portable telephone set the dispatcher was communicated with, who provided an engine from a freight train laid up at the first station ahead. If the portable telephone set had not been available on the train the time lost would have been equivalent to that consumed in walking the three miles.

With the portable telephone sets in the hands of men on the trains, the dispatcher, in the event of an accident, is enabled to talk with the man who knows all the facts in the case. Even if the man on the ground, by reason of the excitement incident to the emergency overlooks some details or assigns to them minor importance, the dispatcher, having the greater experience, may, by his questions, elicit in conversation over the line, a detailed account of the situation which will serve as a basis for his action.

He will know whether to run the wrecker backward or forward, whether to approach the wreck with the crane ahead of or behind the engine and whether the wrecked cars may be dumped off the right of way at the point of the accident or will have to be dragged to some distant point.

It is thus possible, with apparatus now available, to place train crews in quick communication with the dispatcher in the event of any accident or emergency affecting normal train movements, irrespective of the location of the nearest permanent telephone station.

Seaboard Air Line Adding to Telephone System

The Seaboard Air Line Railway is placing orders for telephone train dispatching equipment covering more than 600 miles, with two complete circuits. This installation is being made as a direct result of the increased economy of the telephone over the telegraph as experienced by over a year and a half of service on divisions extending from Richmond to Raleigh, with a branch to Portsmouth, Virginia, and from Raleigh to Monroe, North Carolina.

The first new division being equipped centers at Hamlet, North Carolina, and extends in one direction to Wilmington, a distance of 111 miles, from Hamlet south to Columbia, 106 miles; and west to Rutherfordton, 157 miles, making a total of 374 miles, equipped with 36 stations.

The second division extends from Jacksonville to Tampa, with branches to Orlando and Venice, Florida, 265 miles in all, on which will be installed 38 way station equipments. The dispatcher, in this case, will be located at Jacksonville, and it is intended to operate the branches off the main line by means of polarized relays. The stations on the branches will be called only when they are desired and the selectors will not be operated when stations on the main line are called.

The telephone equipment to be installed on these divisions is of the latest type manufactured by the Western Electric Company, which installed the present equipment on the Seaboard Air Line.

W. F. Williams, superintendent of telegraph of the Seaboard Air Line, is one of the most enthusiastic supporters of the telephone method of dispatching in the country, and the Seaboard, under his direction, was the first road in the south to put this equipment in service.

A Study of Telegraphic Transmission

By Frank F. Fowle*

VII. COMPARATIVE ECONOMY OF COPPER, IRON AND COPPER-CLAD STEEL.

AS a basis of comparing the economy of copper-clad steel with other wires it is necessary to have tables showing the limiting line lengths for different sizes of the several kinds of wire. Since the line length depends critically upon the line resistance, it follows that temperature plays an important part, because the resistance of iron, steel and copper increases with the temperature. The line length also depends critically upon the amount of leakage, and it must be apparent that the maximum leakage will not occur at the maximum temperature, but at the maximum temperature of long summer rains. This has been assumed at 68 degrees Fahr. or 20 degrees Cent.

At this temperature the weight of the mile-ohm for B. B. iron has been taken at 5,500 pounds, for hard-drawn copper at 893 pounds, and for copper clad steel at 2,030 pounds. The latter value was obtained by assuming an average temperature coefficient between copper and steel, in order to be conservative. The resistances of the several sizes of wire were obtained by dividing their tabular weights into the respective values of the mile-ohm. The corresponding line lengths were obtained by interpolation from the curves in Fig. 5, with results as follows:

TABLE OF LINE LENGTHS FOR B. B. IRON WIRE.

B. W. G.	LIMITING LINE LENGTH. Duplex.	Simplex.	Quadruplex.
6	392	304	242
7	352	273	211
8	323	252	190
9	292	228	167
10	266	207	146
11	239	186	128
12	218	171	113
13	192	149	92

TABLE OF LINE LENGTHS FOR H. D. COPPER WIRE.

Wire Size B. & S.	LIMITING LINE LENGTH. Duplex.	Simplex.	Quadruplex.
6	765	585	517
7	691	535	464
8	626	485	419
9	564	437	374
10	510	395	331
11	459	357	294
12	413	321	259
13	372	289	227
14	334	260	198
15	299	233	172
16	269	210	149

TABLE OF LINE LENGTHS FOR COPPER-CLAD STEEL WIRE.

Wire Size B. & S.	LIMITING LINE LENGTH. Duplex.	Simplex.	Quadruplex.
6	517	401	337
7	467	363	300
8	419	326	264
9	377	293	231
10	339	263	201
11	303	237	175
12	273	213	152
13	244	190	131
14	218	171	113

*A report on the use of copper, iron, and copper-clad steel wires in telegraph service, made to Frank R. Chambers, Jr., vice-president of the Duplex Metals Company, August 1, 1910. Continued from the April number of TELEPHONE ENGINEER.

E. B. B. iron and steel are omitted because B. B. iron is the cheapest on a basis of conductivity, at the present market prices. The following table shows how all five materials compare, however, for simplex transmission:

TABLE OF LINE LENGTHS FOR SIMPLEX TRANSMISSION.

Gauge Number	H. D. Copper B. & S.	Copper Clad. B. & S.	E. B. B. Iron B. W. G.	B. B. Iron B. W. G.	Steel B. W. G.
6	585	401	327	304	282
7	535	363	293	273	252
8	485	326	270	252	233
9	437	293	245	228	211
10	395	263	223	207	191
11	357	237	202	186	173
12	321	213	184	171	157
13	289	190	161	149	...
14	260	171	141	...	...
15	233	...	...	...	...
16	210	...	...	...	...

The comparative economy between iron, copper and copper-clad steel will depend upon the kind of morse transmission considered. Telegraph wires on any given

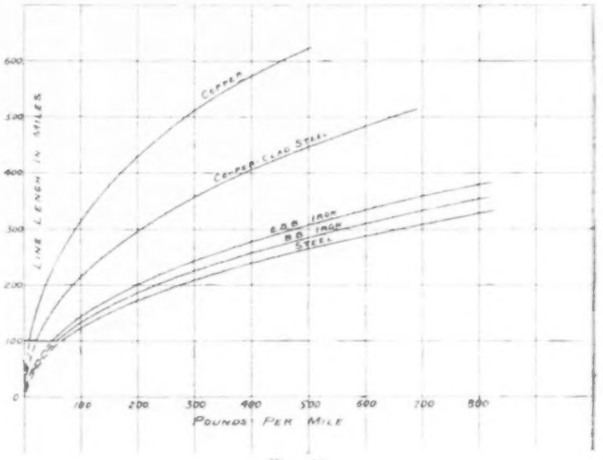


Fig. 10.

route should be to some extent interchangeable, in order that the wire plant may be flexible as regards the assignment of circuits under different conditions and in emergencies. Wires that are used at one time in simplex transmission may be used at other times in duplex or quadruplex transmission, and vice versa. If simplex transmission is used as a basis of comparison, the duplex circuits will have margin to spare, but quadruplex circuits will fail on the neutral side occasionally, in the worst weather. Since this now happens in some cases, it seems fair to take simplex transmission and the corresponding line lengths as a basis for discussing economy.

It may be convenient also to have a set of curves showing the line length in terms of the weights per mile for the different kinds of wire. Such curves have been prepared for the case of simplex transmission and are given in Fig. 10.

The line costs have been computed from the market prices of June 15, 1910, with an allowance for freight where the manufacturer does not assume it. The prices

of iron wire are given at so much per pound, flat. The prices of copper and copper-clad are computed from a base, with adders for drawing and for freight. The base price of copper was $.1425 per pound, and of copper clad $.1400 per pound, less three per cent cash in 15 days, which was deducted. The freight allowance was $.10 per 100 pounds. At the same time the scrap values were estimated. The scrap value of copper was taken at $.1125 per pound less $.10 per 100 pounds as a freight allowance, or a net of $.1115 per pound. The scrap value of copper-clad steel was estimated at $.0386 per pound. This is based on a scrap value of the copper contents at $.1125 per pound less a refining charge of $.015 per

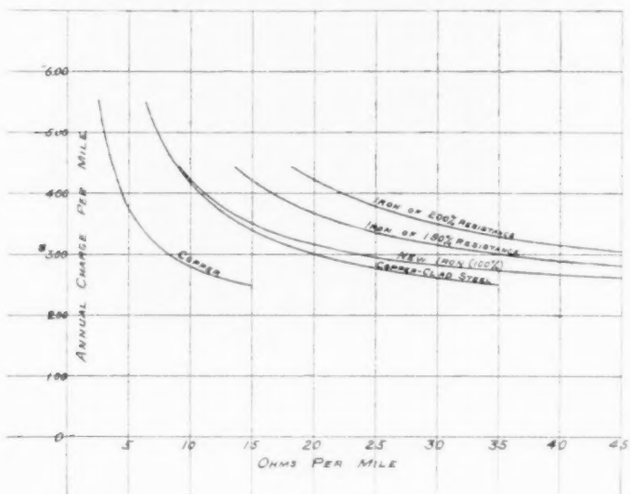


Fig. 11.

pound and a small freight allowance. The calculations of cost and scrap value appear in the succeeding tables. Iron is assumed to have no scrap value.

Cost of B. B. Iron Wire.

Size B. W. G.	Weight Per Mile	Price per Pound	Cost per Mile
6	573	$0.0325	$18.62
7	450	.0325	14.63
8	378	.0325	12.29
9	305	.0325	9.91
10	250	.03375	8.44
11	200	.03375	6.75
12	165	.0350	5.78
13	125	.0375	4.69
14	96	.0400	3.84

Cost of H. D. Copper Wire.

Size B. & S.	Weight Per Mile	Price per Pound	Cost per Mile	Scrap Per Mile
7	333	$0.1435	$47.79	$37.13
8	264	.1435	37.88	29.44
9	209	.1448	30.25	23.30
10	166	.1448	24.03	18.51
11	132	.1460	19.27	14.72
12	104	.1460	15.18	11.60
13	82.8	.1485	12.30	9.23
14	65.6	.1485	9.74	7.31

Cost of Copper-Clad Steel Wire.

Size B. & S.	Weight Per Mile	Price per Pound	Cost per Mile	Scrap Per Mile
7	309	$0.1368	$42.27	$11.93
8	245	.1368	33.52	9.46
9	194	.1380	26.77	7.48
10	154	.1380	21.25	5.94
11	122	.1392	16.98	4.71
12	97	.1392	13.50	3.74
13	77	.1416	10.90	2.97
14	61	.1416	8.64	2.35

The cost of line construction has been calculated on the basis of the cost of wire, insulators, pins, tie-wires, sleeves or joints and labor. The cost of labor has been assumed at $5.00 per mile for erection of all wires, $2.00 per mile for taking down copper and copper-clad wires and $1.00 per mile for taking down iron wires. The pole line costs will be substantially the same in all cases. The total line costs are as follows:

Cost of B. B. Iron Line Construction.

Size B. W. G.	Total Cost Per Mile	Cost of Reconstruction
6	$27.05	$28.05
7	23.06	24.06
8	20.72	21.72
9	18.34	19.34
10	16.87	17.87
11	15.18	16.18
12	14.21	15.21
13	13.12	14.12
14	12.27	13.27

Cost of Copper Line Construction.

Size B. & S.	Total Cost Per Mile	Net Scrap Per Mile
7	$56.33	$35.13
8	46.42	27.44
9	38.79	21.30
10	32.57	16.51
11	27.81	12.72
12	23.72	9.60
13	20.84	7.23
14	18.28	5.31

Cost of Copper-Clad Steel Line Construction.

Size B. & S.	Total Cost Per Mile	Net Scrap Per Mile
7	$50.81	$9.93
8	42.06	7.46
9	35.31	5.48
10	29.79	3.94
11	25.52	2.71
12	22.04	1.74
13	19.44	.97
14	17.18	.35

The cost of line construction for the three kinds of wire as summarized in the next table.

Comparison of Line Construction Costs.

Gauge Number.	Total cost per mile. H. D. Copper B. & S.	Copper-Clad Steel B. & S.	B. B. Iron B. W. G.
6	.....	.....	$27.05
7	$56.33	$50.81	23.06
8	46.42	42.06	20.72
9	38.79	35.31	18.34
10	32.57	29.79	16.87
11	27.81	25.52	15.18
12	23.72	22.04	14.21
13	20.84	19.44	13.12
14	18.28	17.18	12.27

Copper-clad steel lines cost from six per cent to ten per cent less than copper lines, and considerably more than iron lines, of the same diameter.

The comparison of greatest importance, however, is made on the basis of total annual charges. These include taxes, maintenance, depreciation and interest. Taxes will be assumed at one per cent and interest at six per cent. Maintenance costs for wire alone are difficult to obtain because such costs are usually so kept as to embrance the whole line maintenance expense, including pole lines and wires. But in order to include this item of expense, it has been estimated at $1.00 per wire mile per annum in all cases. This item will be larger for small wires and wires of low strength than for wires of large size and great strength, but it is impossible, without the most elaborate analysis of carefully recorded maintenance costs to go into this matter.

Depreciation charges depend upon the life of the wire and the manner of financing the reconstruction costs. The life of copper wire, so far as it is determined by deterioration of the metal, is indefinite. Wires have been up for 25 years or more and show practically no depreciation. Small wires which stretch and break frequently will not, of course, last as long as wires of adequate strength. A life of 50 years has been assumed for these comparisons, and while small wires will probably not last that length of time in the sleet zones, they have been given the benefit of the assumption.

Copper-clad steel wires ought to last as long as copper, because of the protection against corrosion given by the copper coating and the absence of corrosive action at the weld. It has been assumed that they should have the 50-year life.

Iron wires have a variable life which depends greatly upon the conditions. Corrosion sets in after a few years and proceeds to diminish the cross-sectional area and the tensile strength, and correspondingly increases the resistance. Breaks then become more frequent and repairs more difficult. In atmospheres laden with sulphurous smoke, the life is but a few years, while in clean country the life ought to be from 15 to 20 years, assuming in the last case that considerable increase in resistance is permissible. A life of 20 years has been assumed for the present purpose.

Reconstruction expenses can be financed in several ways. One of the most economical plans is the so-called sinking fund reserve method, but it has not been generally followed. Many companies have used the plan of charging the reconstruction in any year to the revenues of that year, which is uneconomical, but simple. If, for instance, a portion of the property lasts 50 years, this plan amounts to setting aside two per cent of the reconstruction cost each year, without interest. In view of the practices of many companies, this plan has been assumed in what follows.

Recapitulating the annual charges—interest and taxes have been taken at seven per cent, maintenance at $1.00 per wire mile and depreciation equal to the net cost of reconstruction divided by the years of life, all on an annual basis. The total annual charges are given in the next table.

TABLE OF ANNUAL CHARGES PER WIRE MILE.

Gauge Number	H. D. Copper B. & S.	Copper-Clad Steel B. & S.	B. B. Iron B. W. G.
6	.....	.....	$4.30
7	$5.37	$5.38	3.82
8	4.63	4.64	3.54
9	4.07	4.07	3.25
10	3.60	3.60	3.07
11	3.25	3.24	2.87
12	2.94	2.95	2.76
13	2.73	2.76	2.62
14	2.54	2.54	2.52

This table shows that the annual charges on copper and copper-clad steel of the same diameter are equal, and both are greater than the charges on iron of the same diameter. But for lines of equal length, the annual charges must be compared on the basis of equal conductivity. The annual charges in the above table and the corresponding resistances in ohms per mile have been plotted in Fig. 11.

These curves show that copper is the cheapest for a given conductivity; and that copper-clad steel is a little cheaper than iron which is new. In view of the gradual increase in the resistance of iron with age, due to corrosion, a factor of safety in resistance should be allowed; so that a new wire will have an excess of conductivity, which will gradually diminish with age. Fig. 11 shows one curve for iron with 50 per cent increase in resistance and one curve for 100 per cent increase. These last curves, in comparison with the curve for copper-clad steel, show that the latter material is considerably more economical than iron, from this standpoint.

There are two kinds and sizes of telegraph wire in very general use. One of these is No. 9 B. & S. hard drawn copper, which weighs 209 pounds per mile. This standard has been evolved from long experience in the use of copper wires, commencing with the smaller sizes. This wire has a limit of 437 miles for simplex transmission; it is used in some cases up to 500 miles without repeaters. For lines not exceeding 250 miles, No. 14 B. & S. has sufficient conductivity, but it weighs only 65 pounds per mile and experience has shown that it cannot be used with satisfaction in line service because of its low tensile strength. In fact, experience has gradually demonstrated that no size less than No. 9 B. & S. is wholly satisfactory as to strength, and even this size breaks in severe sleet storms. Consequently this size has become the standard for the longer circuits.

The other material is No. 8 B. W. G. iron of B. B. quality, which weighs 378 pounds per mile. It has a limit of 252 miles for simplex transmission when new; the limit drops to 208 miles for 50 per cent increase in resistance and to 182 miles for 100 per cent increase. This size has become the standard for the shorter circuits because the annual charges are somewhat less than the charges on No. 9 B. & S. copper. Iron wire of a size as large as No. 6 B. W. G. has been used, in order to secure greater conductivity. This size has a limiting line length of 304 miles. The annual charges, however, exceed those on No. 9 copper and the latter has a greater permissible line length. Smaller sizes than No. 8 B. W. G. have been used for short lines, but in general they do not have a life equal to No. 8, and as they age the tensile strength and conductivity diminish rapidly. The mileage of iron wire now in use is very largely made up of No. 8 and this size is largely standard.

It appears then from Fig. 11 that copper-clad steel is cheaper than copper when the annual charges per mile are less than the charges on No. 9 B. & S. copper, or $4.07 per mile. This holds true for sizes less than No. 9 B. & S., at which point the charges are equal and the line limit is 293 miles. Even at this limit, copper-clad steel is cheaper than copper because of its superior strength and elasticity, which will diminish the maintenance charges.

By taking the properties of materials given, the following comparison has been prepared for the different materials and sizes of wire.

TABLE OF COMPARISONS OF COPPER, IRON AND COPPER-CLAD STEEL WIRES.

Size and Material	Breaking Weight	Elastic Limit	Ohms Per Mile	Limiting Line Length	Annual Charges Per Mile
No. 9 B. & S. Copper.....	613	368	4.27	437	$4.07
No. 8 B. W. G. Iron (new)..1241		745	14.5	252	3.54
No. 9 B. & S. Copper-clad...	970	863	10.5	293	4.07
No. 10 B. & S. Copper-clad..	776	691	13.2	263	3.60
No. 11 B. & S. Copper-clad..	618	550	16.6	237	3.24
No. 12 B. & S. Copper-clad..	490	436	20.9	213	2.95

Numerous conclusions may be drawn from this table but before taking them up it should be observed that the properties given for iron assume that it is new. At the end of 20 years of service it will be conservative to assume that its resistance will double, and corresponding-

ly its tensile strength and elastic limit will be halved, while its limiting line length will be only 182 miles. This result will come about through the corrosion of the wire and in part through the corrosion of the joints. It is very difficult to keep the joints in old iron wire in good condition and of low resistance. The conclusions may be stated as follows:

1. On a basis of tensile strength, new No. 8 iron is superior to No. 9 copper and copper-clad; No. 8 iron of half-strength, No. 9 copper and No. 11 copper-clad are about equal.
2. On a basis of elastic limit, No. 9 copper-clad is superior to new No. 8 iron or No. 9 copper; No. 12 copper-clad is superior to No. 9 copper or No. 8 iron of half-strength.
3. On a basis of conductivity, copper is superior to both iron and copper-clad; No. 10 copper-clad is slightly superior to new No. 8 iron; No. 12 copper-clad is much superior to No. 8 iron of half-strength and double-resistance.
4. On a basis of limiting line length, No. 9 copper is superior to both No. 9 copper-clad and No. 8 iron; No. 10 copper-clad is slightly superior to new No. 8 iron; No. 12 copper-clad is superior to No. 8 iron of half-strength and double-resistance.
5. On a basis of annual charges, No. 9 copper is superior for lines longer than 293 miles; copper-clad is superior for lines of less than 293 miles.

These conclusions rest in part on the present market price of copper and iron wire. The copper metal market is now below normal and an increase over the present prices might alter or modify the conclusions reached. Since the base price of copper-clad is one-fourth of a cent below the base of copper, less three per cent additional for cash in 15 days, the conclusions as regards the substitution of copper-clad for copper are not altered. But they are affected slightly as regards the substitution of copper-clad for iron. The annual charges, assuming an increase of three cents per pound in base price, compare as follows:

TABLE SHOWING EFFECT OF HIGHER BASE PRICE ON ANNUAL CHARGES.

ANNUAL CHARGES.

	Present Market.	Base 3c Higher.
No. 9 B. & S. Copper	$4.07	$4.51
No. 8 B. W. G. Iron	3.54	3.54
No. 9 B. & S. Copper-clad	4.07	4.53
No. 10 B. & S. Copper-clad	3.60	3.97
No. 11 B. & S. Copper-clad	3.24	3.53
No. 12 B. & S. Copper-clad	2.95	3.18

The higher annual charges in the second case would cause the curve for copper-clad, in Fig. 48, to shift to a new position just above the curve for iron, instead of just below it, as at present. That is, at the higher price for copper-clad it would be slightly more expensive than iron on a basis of resistance when new, but when allowance is made for an increase in resistance with age, it will be less expensive, as before.

At the higher price the charges on No. 11 copper-clad are equal to those on No. 8 iron, and the charges on No. 12 copper-clad are less; the latter has a higher elastic limit and a greater line length than No. 8 iron of half-strength. Wherever the life of iron is less than 20 years, the comparison is still more favorable to copper-clad as the depreciation on iron will be increased.

(To be continued.)

New Kellogg Railway Extension Arm

The Kellogg Switchboard & Supply Company has recently designed a new and unique transmitter arm, built especially for railway service.

It is used in connection with regular flexiphone stand and head receiver.

As shown in accompanying illustrations it can be

New Kellogg Telephone Arm.

extended nearly double the closed length, being adjusted by a rubber head screw.

This stand can be furnished for mounting on a flat topped desk or secured to a vertical surface. The telephone proper is pivoted for convenience in using at different angles.

Long Distance Railway Telephony

New Orleans talking to Chicago by the long-distance telephone is now an every-day occurrence with the Illinois Central Railroad. The telegraph as a utility for railroads is rapidly disappearing all over the country, and while most of the Southern lines have given up the clicking key for the more serviceable talking wire, the I. C. has perhaps gone further into the matter than any of the others, making the connection complete between its two great terminal points—Chicago and New Orleans.

All train dispatching on the Illinois Central is now done by the telephone, and, according to an order just issued, most of the messages that were sent by the key are written out and transmitted to Chicago by telephone.

The telephone service, it is held, is far more efficient than the telegraph, and the messages may be sent in much less time. It is only a matter of a few minutes' talking, where previously it was a case of clicking out each letter of every word.

T. E. Hill, superintendent of the Louisiana division, when asked about the telephone taking the place of the telegraph, said that the Illinois Central was one of the first of the great roads to adopt the improved system. Mr. Hill, who is back and forth on the line almost constantly looking after the important duties of his division, said that the telephone from the first had filled every requirement expected of it, and that the service was thoroughly up-to-date and complete.

The Illinois Central has had its forces out all along the line recently improving the telephone service and stringing additional wires and it is probable that in a little while there will be no more telegraphing done, but every message will be sent out by telephone.

An item which appeared in the *London Globe* says that the Maoris of New Zealand are making good progress in the way of rural telephony. A meeting was held by the natives interested in the work and $1,500 raised.

Equipment of the Frisco Lines

By Clifford Weldon

AT Springfield, Mo., is the main private branch telephone exchange of the 'Frisco System. Through this switchboard are switched 150 stations of the road, besides the long distance and Bell Company's stations.

In the switchboard room is a table equipped with the signaling apparatus for message and long distance circuits, all signaling on the message circuits being done by the monitor operators at Springfield. In the method used in calling, the station which calls gives its own name and the name of the station wanted.

The switchboard has two positions, and is equipped with all modern appliances for signaling and handling calls. Each position has a hand generator for calling the monitor operator at night, or whenever she may be absent from the board. Trunk lines connect the main board with smaller boards in the shops at Springfield and the company's new office building.

The Frisco Lines have in service 535 miles of

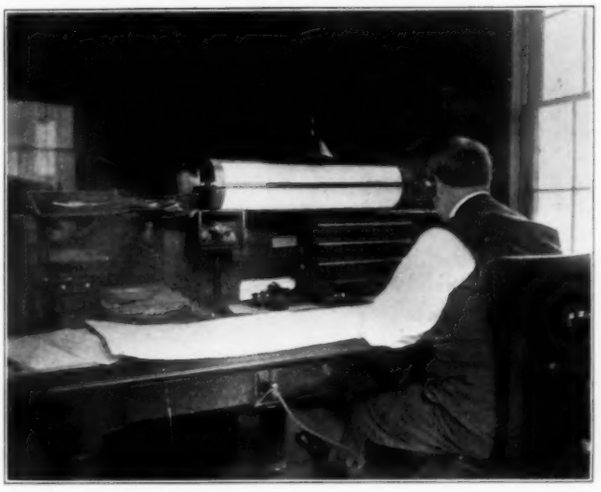
Signaling Cabinet, Springfield, Mo.

automatic electric block signals of the upper right hand quadrant type. Each signal is a distant signal on the next signal in advance, and at stations where there is a train order signal the automatic signals approaching it will stand at "caution," unless the train order signal is at "proceed," this being of particular advantage where stations are located on a curve, and the view of the train order signal is poor.

The territory covered with signals is that where telegraph block was operated previous to the automatic installation. The signals are so arranged as to give a two-mile block, while the telegraph block average was four and a half miles.

Signals are operated on continuous track circuit and line wires, and give indications of train in block, open or improperly closed switch, car within fouling on side track, or a broken rail.

The arrangement of signals on single track, and their controlling limits, give absolute protection at meeting points, and the use of all passing tracks without the expense of block operators at each and every passing track allows close spacing of trains.



The Kansas City Dispatcher.

A recent issue of the *Frisco-Man* contained the following admonitions to employes of the road, under the caption, "Save Your Breath—Also Telephone Service":

"The telephone lines extending from the general offices to Springfield, Monett, Newburg, Fort Scott and Kansas City have proven to be a great convenience, and save a vast amount of correspondence. But it is well to remember that this service, like everything else, has limitations and that ordinary business conversations should never exceed three minutes, and, of course, these lines are only meant for business.

"It does not seem that three minutes is a period of time in which much can be done or said, but experiment will prove that ordinary business conversation can be concluded in much less time than 180 seconds;

The Ash Grove Division Dispatcher.

in fact, two minutes is usually more than enough.

"Make up your mind some time when you are talking over the telephone that you will time yourself and see how quickly you can finish what you desire to say and hear. If all employes would do this the adequacy of our telephone service would be increased practically 50 per cent. Remember that in a large percentage of cases when you are using the telephone someone else is waiting to get on the line whose business is, perhaps, far more important than yours, and the longer you keep the line the more they will be waiting.

"Of course, frequent articles have been written upon the importance of courtesy over the telephone and that is a subject which hardly enters into this, but there is the element of courtesy in the consideration you can show to other employes by not keeping them waiting an unnecessarily long time to use the telephone."

Duluth & Iron Range Railroad Adopts the Telephone

The telephone system of train dispatching has been adopted by the Duluth & Iron Range Railroad, and equipment is now being installed between Two Harbors and Ely, with a branch from Allen Junction to Virginia and Eveleth, in Minnesota. The new telephone system will cover 123 miles and there will be fifteen way stations. This road connects the iron ore producing portion of Minnesota with ports on Lake Superior.

The dispatcher at Two Harbors will have before him a sending key cabinet on which are mounted fifteen keys. The operation of this mechanism is noiseless and rapid. The answer-back feature tells the dispatcher beyond a doubt whether the bell rang at the station. At each way station a local battery selector set is to be installed. No. 9 iron wire is used on this circuit.

The officials of this road decided upon this equipment after an investigation of the operation of the telephone circuits on the Great Northern Railway, which for some time has been making extensive use of the selective system of train dispatching. The stations on the Duluth & Iron Range Railroad are being equipped with telephones and selectors manufactured by the Western Electric Company.

Several Roads Installing Gill Selectors

Telephone train dispatching with selective calling is being rapidly taken up on American railroads, both in new installations and in extensions of a service eminently satisfactory. Among the orders just received by the United States Electric Company of New York and Chicago for Gill selectors are the Seaboard Air Line for 74 stations, the Atlantic Coast Line for 88 stations, the Canadian Pacific lines west for 68 stations and the Canadian Pacific lines east for 187 stations. This road will soon be equipped from ocean to ocean with selective calling and telephone train dispatching.

Telephone Dispatching on the Q. & C.

The Queen & Crescent System has completed the construction of a telephone train dispatching circuit paralleled by a local message telephone circuit on the second district of the Cincinnati, New Orleans & Texas Pacific Railway, which extends from Danville, Ky., to Oakdale, Tenn., 134 miles. The telephone circuits were put in service at 7 a. m. Sunday, April 16, for dispatching trains and transmitting local messages. Although most of this division is double-tracked, traffic is very heavy and the train dispatching circuit is an unusually busy one. It is expected that the telephone circuits will greatly simplify the work of handling traffic. There are more than twenty tunnels in the division, a statement which gives an indication of the character of the country through which the road is built.

Commission Law in Washington

On March 18 the Governor of the State of Washington approved an act creating a Public Service Commission, which makes the valuation of the property of every service company mandatory upon the commission. The members of the Railway Commission constitute the first Public Service Commission. The most important provisions which affect electrical, telephone and telegraph companies are that all rates of telephone and telegraph lines shall be fair, just, reasonable and sufficient, and all facilities and equipment shall be safe, modern and adequate and shall be kept in good condition and repair. Schedules shall be filed with the commission and printed and kept open to public inspection. No change of rates shall be made except after thirty days' notice, but for good cause the commission may allow changes without this notice. Regular and uniform charges shall be extended to all persons and corporations under like circumstances and for like service. Every company shall receive, transmit and deliver without discrimination or delay the message of any other telephone or telegraph company.

Ontario Telephone Act Amended

An amendment will be made to the "Ontario Telephone Act, 1910," which will give the Railway and Municipal Board power to prescribe standard conditions and specifications of construction, equipment and maintenance of all telephone systems in the province. If deemed necessary it may also render advisory or supervisory assistance to any such telephone system. All telephone companies are to furnish the board with yearly reports, and reports may be required at any time the board deems necessary. Lines may be arbitrarily extended at any time to make necessary connections between two adjoining systems. Any transfer of ownership or control to any company not within the jurisdiction of the Ontario legislature must be approved by the lieutenant-governor in council.

Steel Rails for Telephone Poles

In building the telephone line along the railroad in the Isthmus of Panama old steel rails were utilized for telephone poles. The rails were imbedded in a concrete base, which prevents rusting at the base, and also provides a solid support without the use of bracing or guy wires. These make an excellent substitute for wooden poles, which are impracticable in that climate owing to the ravages of tropical insects.

An article in our April number entitled, "Telephones on the Pennsylvania Lines," showed four photographs of various parts of the system. These photographs should have been credited to the *Telephone News*, as it was due to the courtesy of that publication that we were able to illustrate our article.

The Railway Telegraph Department

By John A. Kick

THE means of communication in connection with railway operation is organized under the name of Telegraph Department, although this department has charge of both telephone and telegraph service.

For train dispatching, the telephone is fast supplanting the telegraph and for other service is slowly but surely coming into favor.

A number of the trunk lines now have telephone service between their operating headquarters and the more important terminals, with prospects of extending the service over the entire system.

The progressive railway management has come to view the telegraph department as one which must be of very high efficiency, although this view has not always prevailed on account of the department being classed as non-revenue paying.

It can be demonstrated that first-class service on the telephone and telegraph circuits of a railway system is a source of revenue by saving to the company freight and passenger traffic which must be secured in competition where prompt quoting of rates and routings as well as ticket and sleeping car arrangements and reservations must be made by telegraph or telephone.

A very prominent business man recently called at a trunk line ticket office and made inquiry concerning tickets and reservations to a point which would mean transfer from one depot to another at an intermediate point.

He remarked that he had always taken a competitive line for this trip as he could get off at the intermediate station, arrange for his reservations for the outgoing train from the same depot, and then feel safe to go about the town until train time.

The ticket agent asked details of the intended trip, turned to his telephone, called the intermediate station, arranged sleeping car reservation direct with the line beyond, and gave the patron his car and berth number, all in less time than it requires to tell the story.

The gain to the railway company was the price of a ticket and the good will of a pleased patron who freely expressed his surprise and satisfaction with the marvelous service. The ticket arrangement was made with a point about four hundred miles distant and its success was dependent on first-class service, and should be entered as a credit on the telegraph department ledger. There is an agreement between railways whereby each road agrees to pay so much per car per day for all foreign cars on its lines; also agreeing as to the proper point of delivery for cars enroute to home line.

When a foreign car is unloaded a telegram or phonegram is sent to the contracting department, asking for "home route" directions, and upon the prompt handling of these requests and answers depends the termination of the per diem charges.

Delays in handling this class of business mean loss of money, which could be placed to the credit side of an efficient telegraph department; and so it runs through all departments, which are receiving telephone and telegraph service.

There are no known means to put the railway telegraph department actually on an income basis, as its greatest value is in giving free service to all other departments in such full measure as to be effective to the extent desired by the writer of the telegram or the user of the telephone.

The good condition of the telegraph department of a railway is of the utmost importance, as it is the means whereby the commanding general reaches his field generals in planning and directing the movements of his army of men.

The telephone is one of the most important utilities of the progressive railway organization, as by its use the directing members of the organization may confer at any time as well as reach any part of the system personally to direct their subordinate officers. The telephone is superior to the telegraph for general railway service, as it is instantaneous; does not require education or practice to handle; answers are received directly, allowing further questions and answers, or a number of questions and answers are exchanged on one telephone call which might require a series of telegrams extending over several days; and this service extends to the bedside of almost every railway official in the country.

Railway operation is being brought within more scientific lines; each year special men are being employed, departments in some cases entirely reorganized, antiquated methods discarded for the modern, and in general the "good old days" are fast becoming memories only.

Engineering skill has been gradually drawn into railway work and with all other departments specialized and in a high state of efficiency, the telegraph and telephone service must be of the highest order, and it is for this reason that the telephone has become so popular in that service.

The telephone system of the larger terminals is of incalculable service and I doubt the possibility of satisfactorily handling some of our present day freight terminals without the service which results from having telephones placed at every advantageous point—including fifty to a hundred telephone stations in a single yard. A number of the railways have adopted the grounded telephone line as a means of station to station manual block, and others have gone still further and extended a telephone connection to all outlying siding switches; others have placed means of telephone connection with the dispatching circuit at intervals not exceeding two miles.

The telephone and telegraph department under capable management and with the financial aid and encouragement of the general executives must and will develop with the other departments, providing a saving sufficient to represent an acceptable return on the investment.

A. C. H. Dalley, Minneapolis, has arranged an indestructible phonograph record in combination with a loud-speaking telephone to be mounted on the front of an automobile, a touch of the chauffeur's button causing the new auto horn to hurl in raucous notes at fleeing pedestrians the name of its car or any other phrase desired.

A System of Wireless Train Control

By A. F. Miller

A SYSTEM of automatic train control which operates wirelessly, has been invented by Frank W. Prentice, Toronto, after years of experimentation in the face of unusual obstacles. The system was recently given a test on a section of the Canadian Pacific railroad in West Toronto. It is operated by wave control. The system consists of two parts; one part being located on the track and the other on the engine. The track circuit and the wave generator are the essential parts of the track portion, Fig. 1. The generating system consists of the transformer *T*, the condenser *C*, and the oscillatory discharge points *PP*. A set of this apparatus is placed at the end of each block and a No. 12 aluminum wave wire, run midway between the rails as shown, is extended for a block length in the rear. The track circuits of the block in advance control the generating system. As long as the current through the track circuits is not broken or short circuited, the alternating current relays *R*, keep the transformers connected with the alternating current feed wires, stepping the 110 volts up to about 22,000 volts, which causes an oscillatory discharge to take place continuously between the oscillators *PP*. The insulated wave wire *W*, and the pick-up wire, *U*, are connected to the oscillators, extending along the track in the relative positions shown. When the block in advance is clear the wires *W* and *U* are charged with the wave producing current and send out waves continuously as in wireless telegraphy. All the track blocks are provided with the ordinary form of vane type relays and alternating current track circuits.

The part of the system located on the engine embraces the main antenna, which consists of an aluminum plate four inches wide and nineteen feet long, which hangs directly over the wave wire.

A pick-up antenna, which is suspended in like manner on the right hand side.

A small turbine generator.

The train control mechanism, the main part of which is the coherer, *22* and *23*, Fig. 2, consisting of a wood fibre receptacle having a hole in the center, and two lugs inserted in its bottom ¼ of an inch apart, this space being bridged with filings.

The coherer is rotated through ninety degrees by a solenoid rack and pinion, being held in the upright position two seconds each time, and while in this position the wireless waves makes the coherer a conductor and the master relay, *15*, is operated. The rotation of the relay causes the filings to de-cohere.

As long as the engine is in service the coherer is in operation constantly, opening and closing the master relay every three seconds when the wave is being received. A series of ten holding relays, *3* to *12* inclusive, is connected to the master relay. These relays will hold their magnetism one second each after the current is broken. All being in parallel, No. *12* releases its contact just ten seconds after the master relay ceases to be operated by the wave controlling influence.

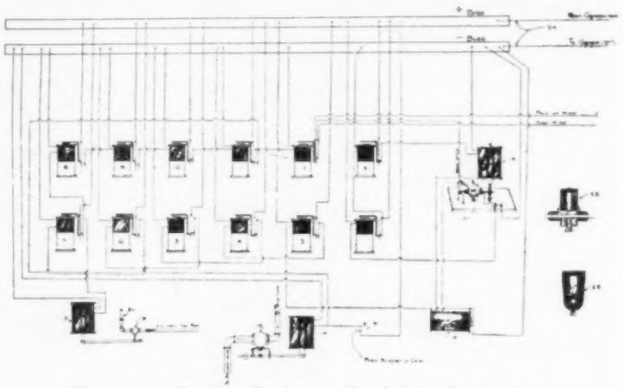


Diagram of Prentice Equipment Carried by Locomotive.

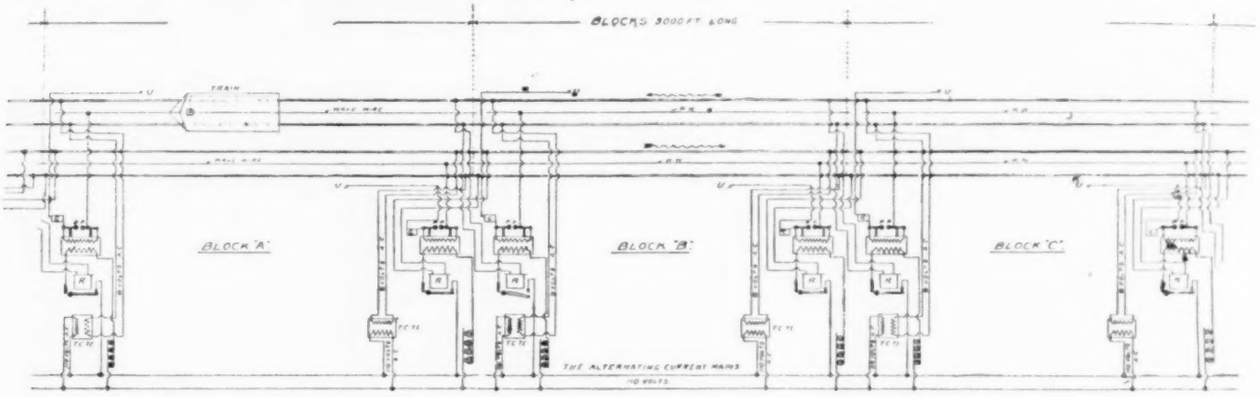


Diagram of Three Consecutive Blocks, Showing Prentice Apparatus and Connections.

Relay No. 7, when closed, operates solenoid *13*, whose plunger holds valve *19* closed, and prevents the air from the main reservoir blowing whistle *20*. Relay *11* in the same way operates solenoid *14*, which holds valve *18* closed and prevents escape of air from train line through a one-inch port.

Solenoid *14* is also controlled directly by the engineer by means of a push button, *21*.

Relay *12* has a front and back contact and a common, connecting with coherer *17*. When relay *12* is

closed its common is in connection with the main wave wire antenna under the engine, and when disengaged is in connection with the pick-up antenna, under the steam chest.

When the engine enters the wave zone the wave is caught by the pick-up antenna, reaches the coherer through its contact on relay *12*, closes master relay *15*, which in turn closes relays *3* to *12*. The engine is now under control of the wave and master relay *15* will be opened and closed every three seconds as long as the wave is being received; consequently relays *3* to *12* will remain closed.

In the case of a train standing in the way of an approaching train, the wheels of the standing train short circuit the current and stop the wave. The coherer failing to receive the wave, the master relay *15* remains open. In one second relay *3* opens and relays *4*, *5*, *6* and *7* open successively, each one second later, and in five seconds after entering the block solenoid *13* drops its valve, *19*, and the whistle, *20*, starts blowing; four seconds later relay *11* opens, solenoid *14* is de-energized, the train line valve opens and the air brakes applied to engine ten seconds after the trouble zone is reached.

Associated Press Service by Telephone

About thirty newspapers, the greater part of them in the Central West, are receiving the Associated Press service now by telephone instead of telegraph. In almost every instance this change was brought about by the action of the Interstate Commerce Commission in assuming control of the telegraph companies.

A group of papers taking the service from any one central office is known as a circuit, and some of these circuits were stretched over such a sparse territory that it was impossible at the start to institute the telegraph service on any mileage basis, such as obtains in the greater part of the country. In these cases the companies granted flat rates. No other arrangement would have made reasonably possible the supplying, for instance, of El Paso with the news from the most convenient central office in Denver.

When the Interstate Commerce Commission reached its decision affecting telegraph companies last August, the companies notified the Associated Press that they could no longer continue what looked like rate discrimination and some other plan had to be hit upon. In the case of El Paso a leased wire had to be obtained, but in many cases it was decided to substitute the telephone for the telegraph.

This idea was not a new one. It had been suggested some years before, but dropped because many of the officers were skeptical as to its efficiency. They felt that the telephone system at that time lacked privacy, for then it was impossible to tell when some one was cutting in and listening to the news as it passed. Subsequent improvements in the telephone and the necessity of the situation have led to the present change, and telephone service is now sent out from Chicago, Cincinnati, Oklahoma City, Milwaukee, Omaha, St. Louis, and St. Paul. It is reported as working a most satisfactory manner.

Arrangements are made whereby several receiving points are connected, and all get the same service at one sending. A central office was installed at Des Moines for this sort of service exclusively, and the news is sent on from there to Marshalltown, Cedar Rapids, and to two papers at Waterloo.

Fixed call periods are set for both afternoon and evening, each period of a half hour's length. The material to be sent in any given period is arranged and written with the idea of its taking just a half hour to read, and this, experience shows, allows some 1,200 words. The central telephone operator has the schedule of periods on file, and for the reading at nine o'clock she begins beforehand to connect the towns and the newspaper offices in them so that at nine o'clock she is able to notify the central office that the wire is ready.

Then the news is read into a special instrument and in each newspaper office on the circuit an expert typist, wearing a head telephone receiver, takes down the news as it comes. This system is more direct than by telegraph, but it does not permit of the abbreviations and all the offices must wait while the sender repeats for any one that does not hear distinctly. After a little practice, however, it is found that senders and receivers harmonize their methods and work with a minimum amount of friction and delay.

The only town that takes the telephone service from Albany is Oneonta. The greatest distance over which this means of sending the news is used is that from Chicago to Houghton and Marquette, Mich. The amount sent varies throughout the service from 1,000 to 5,000 words.

Some More Fire Heroines

Four Patchogue, N. Y., telephone girls stuck to their posts in the exchange on the third floor of a burning building and refused to permit the firemen to enter, because the rules did not permit. The fire was discovered in a grocery store on the ground floor by a passerby. He turned in an alarm, and the volunteer firemen were soon on the scene.

In the excitement the four girl telephone operators on the third floor were forgotten. When some one remembered their peril several firemen fought their way upstairs though the smoke only to find the door of the switchboard room locked. They pounded on it with their fists.

"You can't come in," announced one of the girls; "it's against the rules of the company."

"But the place is on fire," expostulated the volunteers.

"Why don't you tell us something we don't know," called the girls in chorus.

Exasperated by this cold rebuke, the firemen retraced their steps and ascended the rear fire escape, more determined than ever on rescue. Through a window that had been opened to let out the smoke which filled the room and which the girls barred with their arms to prevent the firemen from entering, the volunteers pleaded with the young women to leave while yet there was time.

"We won't leave here until we have to," declared the spokeswoman of the quartet. "There doesn't seem to be very much danger yet. Anyway, it's against the rules for us to leave until our relief shift comes in at midnight. We can watch the fire through the airshaft and when we think we are in real danger we'll call on you—that is, if we can't get out ourselves. Good night."

There was nothing for the firemen to do but descend again, which they did, muttering about the perversity of some people. The fire burned for half an hour, but the girls never left their posts.

Unique Long Distance Entertainment

What is declared the most novel entertainment that ever has been provided for any man's guests in this country, possibly in the world, went over the telephone wires from all parts of the United States into the dining room of U. N. Bethel, vice president of the American Telephone and Telegraph Company, in Montclair, N. J., on a recent occasion.

By means of giant transmitters in Boston, Washington, Detroit, Chicago, New York and other cities, prominent after-dinner speakers, vocalists and entertainers of all sorts contributed to the joy of the Cliff Dwellers, a social organization which has its home on the side of Orange Mountain, in the New Jersey suburb.

Special receivers were arranged in Mr. Bethel's dining room in Montclair, so that his guests might hear the different features of the entertainment provided for them without difficulty. There were a large number of these receivers.

The Chicago end of the entertainment began about 9 o'clock, central time. Two circuits were provided in the office of the local telephone company, one an "order" circuit, so that the people in Montclair could signal when the fun was to begin, and the other a talking circuit over which the speechmaker, the singer or the entertainer projected himself a thousand miles into the presence of the New Jersey society.

W. R. Abbott, one of the executives of the Chicago Telephone Company, and the superintendent of the suburban telephone service, made the opening address. Following Mr. Abbott, Wilbur D. Nesbit talked. The next speaker was from Detroit, followed by Angus S. Hibbard of Chicago, the versifier of the Chicago Association of Commerce, who sang a song he composed especially for the occasion into the transmitter in the City of the Straits.

The entertainment was regarded as one of the most remarkable and interesting from a scientific standpoint, as well as from the fact that the leading talent in the large cities of the country was literally canned and transmitted for the benefit of Mr. Bethel's guests.

Chicago to Be a Bell Center

Plans are being made by the Bell telephone interests for uniting the following telephone companies under the management of a central office at Chicago: The Central Union Telephone Company, which comprises all Indiana, Illinois and Ohio, except the cities of Chicago, Cleveland and Cincinnati; the Wisconsin Telephone Company, covering Wisconsin; the Michigan State Telephone Company, covering Michigan; the Chicago Telephone Company and the Cleveland Telephone Company. These companies will continue to maintain separate identities as individual companies, and the chief difference in their management will be that they will be administered from a central office instead of from five offices.

If this plan is carried through the head offices of the Central Union Telephone Company, now in Indianapolis, will be removed to Chicago and will be merged with the central office.

L. G. Richardson, president of the Central Union Telephone Company, said that plans were on foot for bringing about a centralization of the management of the companies, but that the plans were not likely to be consummated for a few weeks. While it looks as if the plan will be carried through, further consultations with officers of the various companies must be had before it is finally adopted, he said.

It is probable that in case the plan is effected, Mr. Richardson will become general counsel of the united companies, and that H. F. Hill of Indianapolis, vice-president and general manager of the Central Union Company, will become the general manager of each of the five companies.

B. E. Sunny, president of the Chicago Company, will become president; Alonzo Burt, president of the Wisconsin Company, will become treasurer; B. W. Trafford, general manager of the Michigan Company, will be vice-president, and John A. Pritchard, auditor of the Central Union Company, will become auditor of the united companies, according to present plans.

Turkey Ready for Telephones

The concession for the establishment of a telephone system in Constantinople has been definitely awarded to Mr. Herbert Laws Webb, representing an international syndicate in which British firms are largely interested. The consent of parliament is, however, required before the contract is finally signed.

After long delays Constantinople will have the benefit of telephone communication. The negotiations of which this concession will be the ultimate outcome were opened in October, 1908, when Mr. Laws Webb, representing a combination which included the Western Electric Company of Chicago, British Insulated and Helsby Cables, the French Thomson-Houston Company and certain directors and officials of the National Telephone Company, first approached the Turkish government with a proposal to establish by private enterprise a telephone system in Constantinople. The disturbed condition of the country was, however, prejudicial to any concession being granted, and it was not until the end of 1909 that the project was approved, subject to the consent of the minister of finance and the commission appointed to deal with the subject.

The scheme includes the provision of an exchange which will in the first place be equipped for 10,000 subscribers. The area to be served extends over about 150 square miles, comprising the whole of the city and suburbs, including Stamboul, Para and Galata, Scutari and other places on both banks of the Bosporus, as well as the numerous resorts of the Sea of Marmora as far as San Stephano. The geographical character of the area covered by the concession will involve the provision of submarine telephone cables across the Bosporus, and the system will be somewhat unique as giving telephone communication between Europe and Asia. The estimate of capital required for the new undertaking is $1,250,000. Turkey has up to the present time been the only European country not possessing a telephone system.

Telephone Rates in Europe

The rate for unlimited service is $49 in Antwerp and Brussels, $78 in Paris, $58 in Lyons, $20 to $44 in Germany, according to size of exchange; $39 to $58 in Italy, $25 to $28 in St. Petersburg, $37 to $41 in Moscow, $83 in London, and $23 to $81 in Austria, according to statistics recently collected by the British government on European telephone lines. Measured service is also supplied in many places.

Of Interest to the Trade

By A. L. Haase

Interesting and Valuable Bulletins

In the last fifteen years of independent telephony the Kellogg Switchboard and Supply Company has been prominent in the distribution of practical telephone information in the form of illustrated bulletins and catalogues.

These have done more than advertise Kellogg apparatus. They have been a significant factor in the dissemination of good, practical ideas in the telephone work.

Furthering this idea, the latest bulletin issued by the company, No. 56, on Magneto Swithboard Operation, will be found an interesting compilation of sensible telephone operating facts.

This book has 86 clearly printed pages, 133 illustrations, including an appendix which presents a brief historical survey of magneto switchboard progress and the part which the Kellogg Company has done to make the "Independent" switchboard of today what it is—unexcelled by any in the world.

In this bulletin is a complete and comprehensive chapter on the Kellogg double supervision, which shows, with circuits, the various imitations of the Kellogg system.

There are chapters on Installation, Power Ringing Equipment, Switchboard Protection, Wall Switchboard Equipment, Recall Lamps, Pilot Equipment, Lamp Transfers, Circuits, and the other vital features of the magneto board.

The chapter on circuits contains simply drawn etchings which make each circuit plain and comprehensive. The beginner in telephony will appreciate this arrangement especially.

There is an important chapter on cords, which play so decisive a part in good exchange service; also a complete description of what drops and keys should do, and what they should be made of to do this in the right way.

Aside from the circuits, the illustrations are all excellent half-tone reproductions from photographs and cover every important piece of apparatus as well as the complete boards in their various sizes.

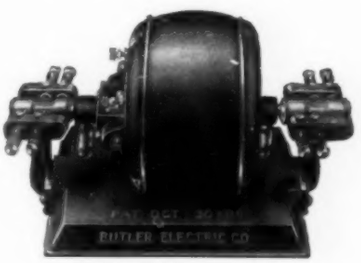
This book was written by H. N. Faris, a practical telephone man of long experience. Mr. Faris is manager of the Kansas City branch of the Kellogg Company and is a telephone man of wide acquaintance.

Some Butler Electric Company Products

W. E. Butler, engineer for the Butler Electric Company, David City, Nebraska, states that his company had been manufacturing the Butler ringing machines for the past three years, during which time the capacity of the plant has been taxed to its utmost to keep up with the large number of orders received from the various Bell companies. On January of this year arrangements were made to increase the output and enable the company to solicit business from all telephone companies.

The Butler ringing machine is especially adapted for medium size exchanges where storage batteries or twenty-four hour electric light current is available. It is built on the principle of a motor and operated in the same manner. The winding of the motor is such as to consume but a very small amount of current. The ringing current is taken from a commutator which is so designed as to give a maximum contact and assure uniform ringing current. Each type of machine is wound according to the current from which it is to be operated.

As the illustration shows, this machine is small, occupying a space of only 7 by 9 inches and has proven to be one of the most efficient ringing machines on the market. The company makes a specialty of ringing equipment, and the fact that several of the larger Bell companies have adopted this machine as standard is evidence of the success with which it has met.



Butler Ringing Machine.

The Butler Electric Company has also recently placed upon the market the mercury lighting arrester, which is attracting considerable attention. This arrester consists of two glass receptacles containing a quantity of mercury with a carbon binding post projecting from the cap or top of the arrester to within easy reach of the mercury, the idea being that the lines connecting on the cap of the arrester and the ground to the mercury allows a very easy passage for lightning or other foreign current to take to ground. The principal feature of this arrester is that it is self cleaning.

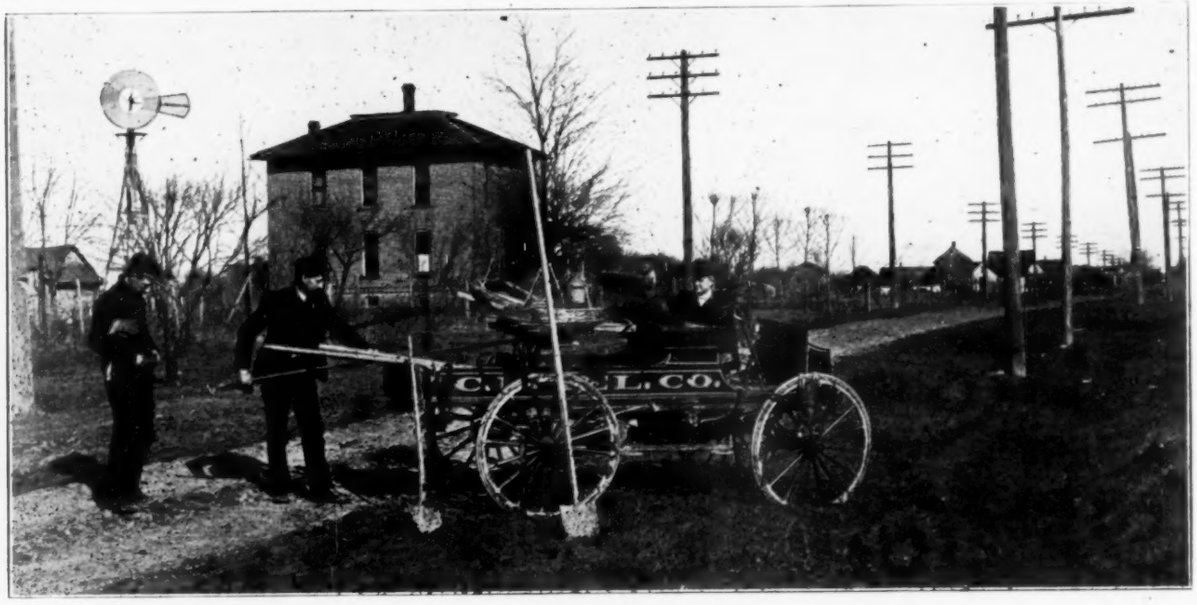
Bulletins covering these two lines are now being furnished to the trade.

Book Review

"Public Ownership of Telephones on the Continent of Europe," by A. N. Holcombe, published as one of the Harvard Economic Studies, is decidedly worthy of its inclusion in that admirable series of books. It is a study of telephone problems in their eocnomic and social aspects, and the treatment is detailed and exhaustive. The author's attitude is at all times honest and impartial, the scientific attitude, drawing only such conclusions as the facts indisputably warrant. It is a book which should interest all practical telephone men, as it will give them a glimpse into the economic and social bases of telephone administration such as they have seldom had offered them before.

Published by Houghton-Miffiin Company, Boston. Bound in cloth; price, $2.00.

Stringing Wires from a McIntyre Wagon.



Loading Up for the Trip.

McIntyre Wagons in Telephone Work

The use of motor vehicles by operating telephone companies has passed the argumentative stage, and the majority of large and medium sized companies are depending in their daily routine on the use of automobile runabouts, wagons and motorcycles. Each of these varieties of vehicle has its distinct uses; and it is obvious that where it is necessary to transport cable and construction supplies in general, the motor wagon is the thing.

Aside from the reduction in maintenance expense brought about by the use of one or more motor wagons in telephone work, there are many advantages in the way of improvements in the service and the satisfaction of subscribers. The ability of the telephone company equipped with motor wagons to repair a case of trouble promptly, no matter how serious it may be, adds vastly to its prestige as a public utility.

The construction of new lines and extensions, the installation of any considerable number of instruments on a new line, the repair of lines damaged by storm, all require some sort of vehicle for the transportation of material—and these conditions are constantly met as a part of the daily routine. Since the only alternative, if a motor wagon is not used, is a horse-drawn vehicle, a comparison is at once instituted between the two forms of motive power—the horse and the gasolene motor. As a mere matter of expediency, the motor wagon may be said to "get there and back" while a team of horses is being hitched up. The direct result of this convenience and saving of time is that the repairs are made or the new instruments installed, as the case may be, at the earliest possible hour—several jobs being completed in one day, which would very likely each require a day using horse-drawn vehicles. This naturally gains friends for the companys—a factor which may be worth more than the mere money saving.

That there is a real money saving is well attested by experience.

One of the most popular of the automobiles used for this work is illustrated on this page and the opposite one. It is made by the W. H. McIntyre Company of Auburn, Ind.

The solid rubber tires should appeal to the prospective buyer, as that feature eliminates all the puncture and blow out delays peculiar to the pneumatic tire and reduces all the expense for this class of repairs.

This car is a standard telephone style body on the regular McIntyre chassis, of which only one important feature besides its strength needs to be mentioned: The position of the motor, which is mounted on a sub-frame, thus forming a unit which may be removed without disturbing the other parts of the car.

Making Repairs While the Wagon Waits.

The motor is the well known air cooled type, which is especially valuable for country work. The company features this air-cooling, calling attention to the fact that it is usually difficult to obtain water in country districts and especially in the western portions of the country.

The axles are forged steel as are the steering knuckles, all equipped with roller bearings throughout.

The jack shaft and differentials are another strong feature of this car. The differentials and gears are all enclosed in a dust proof case. The jack shaft is suspended and of the floating type, being housed in such a way as to admit of being lubricated with hard oil. Perfectly fitting steel sprockets on either side are so constructed as to reduce the noise, meshing the chains snugly and eliminating the wear on chains and gears.

Perhaps a concise description of the standard telephone model No. 251 would not be amiss here.

Capacity—1,200 pounds. Standard Body—Express, panels 8 inches deep inside. Ironed on top all around. Strap irons on bottom, drop end gate. Special bodies can be supplied to suit purchasers. Length of Body Back of Driver's Seat—68 inches. Width of Body Back of Driver's Seat—45 inches. Wheel Base—86 inches. Tread—56 inches (wide track $15.00 extra). Wheels—Artillery type, 34-inch. Tires—Front 34x1¾-inch, rear 34x2-inch, solid rubber. Clearance—14 inches. Drive—Single chain to jock shaft, double side chains. Frame 2x2¼-inch angle steel, hot riveted, 32x112-inch. Springs—Four full elliptic 1½-inch six leaf oil tempered spring steel. Axles—drop forged steel. 1½-inch square, roller bearings throughout. Motor—Two cylinder, off-set opposed, bore 4¾-inch, stroke, 4¾ inch. Horse Power—

20. Cooling—Air cooled. Location of Motor—Under body. Transmission—Improved planetary. Speeds—two forward, one reverse. Gear Ratio—6½ to 1. Gasoline Tank Capacity—Ten gallons. Oil Tank Capacity—2½ quarts. Mileage Capacity Per Gallon—15 to 20 miles. Ignition—Dual system, magneto and dry cells. Clutch—Multiple disc. Lubrication—Mechanical self contained. Carburetor—Gravity float feed. Steering—Hand wheel, worm and sector type. Control—Spark and throttle on steering post. Brakes—Two contracting on rear hubs. Speed—4 to 20 miles an hour. Equipment—Oil lamps, horn and tools. Standard Coloring—Red body and gears, black stripes. Total Length—115 inches. Total Width—66 inches. Net Weight—1,850 pounds. Gross Weight Crated Tight for Export—2,600 pounds. Cubic Measurements—300 cubic feet.

The company calls special attention to the fact that air cooled motors should be kept very well lubricated at all times, this attention assuming perfect working without the danger of overheating.

Any further information regarding this trouble wagon can be obtained by writing direct to the W. H. McIntyre Company, Auburn, Indiana.

Electric Storage Battery Builds Concrete Factory

It has just been announced that the Electric Storage Battery Company, at 19th street and Allegheny avenue, Philadelphia, has closed a contract with John C. Brown, designer and builder, Witherspoon building, for the design and construction of a new reinforced concrete building which will be the largest manufacturing building of this type in the city of Philadelphia.

This addition to its present plant will be a building approximately 300 feet long by 115 feet wide, six stories high, with a one-story triangular extension about 80 feet by 120 feet. These buildings will be constructed by the patented system of mushroom reinforced concrete construction and will be designed to meet the particular demands of this company.

The demand for storage batteries of this company's manufacture has increased to such an extent that it has been necessary to provide additional manufacturing facilities at once.

The Electric Storage Battery Company has recently closed contracts with many of the large electric lighting companies for enormous "Exide" storage batteries for emergency service, and these large orders, together with the enormous demand recently made upon the company for the "Exide" and the new "Ironclad-Exide" electric vehicle batteries have greatly increased the business of the company.

These new buildings will be of the most up-to-date design, strictly fire-proof, will be provided with the most modern machinery and the best facilities for the convenience of its employees. The construction of these buildings is to start at once, to be completed during the fall and will give employment to a large additional force of workmen.

Chase Motor to Occupy New Building

On May 1 the Chase Motor Truck Company will move its New York offices to its new building, 142-4-6 West 50th street. Among telephone companies the Chase telephone repair wagon is meeting with a great deal of success. Records show that the efficiency of these cars is very high, which, coupled with a very low cost of operation, makes a truck bound to give great satisfaction. In construction and working parts, the Chase motor is very simple; in fact, when compared with some other trucks on the market the working parts seems ridiculously few; but the manner in which it stands up to its work and is always ready for service, proves that this simplicity is one of its best features.

The new building of the Chase Motor Truck Company is a two-story affair, which the company will occupy exclusively. The building itself is seventy-five by one hundred feet. The second floor will be occupied by the New York offices and sales room, while on the first floor there will be a garage and maintenance department, which will be run for the benefit of the company's customers.

Seaman Booths Have Long History

Telephone booths are not by any means a new idea, yet there are telephone companies operating today which have not yet recognized the fact that the judicious use of such booths actually increases the revenues of the company, especially where pay stations are extensively used. Many people will hesitate and finally refrain from using a "public" telephone because it is entirely too public, and affords the casual bystander an opportunity to hear at least one-half of the conversation. The installation of booths would make customers of these people and add their mite to swell the receipts of the company.

The W. S. Seaman Company, at Milwaukee, Wis., has been manufacturing telephone booths for about twenty-five years, and claims to be the first in the field to develop this business actively. To this end the company has co-operated with telephone companies in bringing the value of booths before the public.

The company does an extensive business with Bell and independent operating companies, and prefers to hold all negotiations with such companies rather than with the public direct, thus protecting the telephone companies, it being the purpose of the Seaman Company to encourage the operators in distributing booths among their customers.

China's First Real Telephone System Giving Service

A cablegram has been received by the Western Electric Company stating that the two telephone exchanges which it has been installing in the city of Peking, China, were successfully put into service April 2. These exchanges are both of the common battery type and are equipped for 6,400 lines apiece. At present 3,000 subscribers' lines are connected to this telephone system, which is owned and operated by the imperial government.

There have been no adequate telephone facilities in China. The need for a telephone system became so apparent a couple of years ago that an imperial commission was sent abroad to study the telephone systems of other countries. The commissioners were impressed with the facilities and service in New York City and recommended an equipment along similar lines for the Chinese capital. The contract was awarded to the Western Electric Company, after its system had been carefully considered with others, both in Europe and America. The cost of the original equipment is in the neighborhood of $150,000.

The new telephone system covers the whole of both the Tartar and Chinese cities. Underground cable, 3½ inches in diameter and containing 400 paper insulated wires, has been used. The telephone system will employ about thirty operators, all of whom will be Chinese girls. The foreign residents in Peking are particularly pleased with the arrangement of one section of each switchboard for their use. English speaking operators will be employed on these sections.

The "Rate Raiser" Switchboard

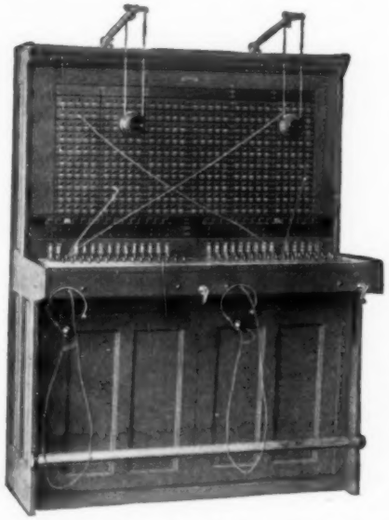
Every telephone system as it grows from a small to a large one must some day change from the magneto to the central battery method of operation. Often, however, when the time arrives to make this change, many companies find it impossible to make a complete change from magneto to central battery on account of financial reasons.

Heretofore if a telephone company could not raise the necessary capital to purchase a new central battery switchboard, a new power plant equipment or new telephone sets, or to remodel the old telephone sets, if practical, it has been necessary for that company to continue to give the more costly magneto service. A telephone company in this predicament has a hard problem to solve, and, furthermore, this problem becomes all the more difficult as the number of lines increases, for the addition of new subscribers means more magneto telephone sets and additional switchboard apparatus.

It was with this point primarily in view that the Western Electric Company placed on the market a new line of magneto convertible non-multiple switchboards.

These switchboards are so designed that they can be used originally for magneto service, and then converted at will for central energy operation.

These switchboards are so arranged that the supervisory signal of the cord circuit can be operated on either central battery connection or magneto connection, or on a combination of both. They are usually equipped with universal cord circuits, by means of which it is possible for the operator to connect magneto to magneto, magneto to central battery and two central battery subscribers. The operator does not need to know whether the two lines to be connected are magneto or central battery. She only plugs into the jack and the cord circuit automatically adapts itself to the condition then required.



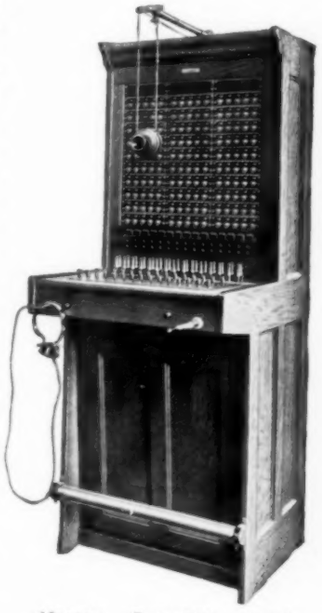
Magneto Convertible Switchboard for 330 Lines, 30 Transfers. Non-Multiple.

When such a switchboard is converted to part magneto and part central battery, all the apparatus originally furnished with the switchboard is retained and the apparatus performs the same functions under the new conditions. It is necessary, of course, to add a small amount of apparatus in the cord circuits. As a rule, in every telephone system there will be required some magneto lines, either of the bridging, rural or toll type; thus, after all the city lines have been converted to central battery, there will still be a demand for a certain number of universal cord circuits. After the conversion has taken place the new city lines, added from time to time, will be on a straight central battery basis, and the additional sections of switchboard that may ultimately be required to contain such lines will be of the straight central battery type.

By adopting this type of switchboard the telephone company will find it a comparatively easy matter to finance a change from the small magneto exchange to the central battery exchange. By this means the money then spent for a switchboard will not be lost when the complete change to central battery becomes necessary.

The purchase of central battery telephones can be made at various times, as the number of central battery subscribers increases. If at the time of the change the number of subscribers is sufficiently small, the expense of a power plant, with its charging outfit and storage battery, can be avoided by the use of dry cells.

Since with the use of this convertible type of board it is possible to convert any one of the subscriber's lines at any time, it is thus possible to furnish central battery service to any subscriber at such times as he desires to pay the increased rates for this better class of service. The telephone company in this way can raise its rates and at the same time have satisfied customers and a dividend-earning plant. Because of its adaptability and its rate-raising possibilities this switchboard has been called the "Western Electric Rate Raiser."



Magneto Convertible Switchboard for 115 Magneto or Central Battery Lines. Non-Multiple.

These switchboards are made in two sizes, the No. 1256, having a capacity of 330 magneto or common battery lines, 30 pairs of cords and 30 transfer circuits, and the No. 1246, having a capacity of 165 magneto or common battery lines, 15 pairs of cords and 15 transfer circuits. They are so designed and constructed that any number of sections can be readily lined up together, so as to make a switchboard with several positions without making a single change in the woodwork of the cabinet, and the sections when so arranged present the appearance of one continuous cabinet.

An important feature of these switchboards is the cord circuits. These circuits are extremely flexible, for, without disturbing the wiring of the board and adding but a few pieces of apparatus, five different combinations can be made.

Any of these changes can be made easily and quickly. For example, the addition of the converting relay, which changes the cord circuit from magneto to common battery operation, is made by simply cutting the loop wires back of the switchboard and soldering the relay. To change any line from magneto to central battery operation is equally simple. It is only necessary to change a couple of strap wires on the signal itself.

These magneto convertible switchboards are characterized by easy and economical operation, accessibility of all parts, low maintenance expense and are readily adaptable to every service condition.

Western Electric Company's March Business

Sales of the Western Electric Company in March were ten per cent larger than for the same month a year ago. For the first quarter of its fiscal year to April 1 the company has done eleven per cent more business than in the same period a year ago. For the full twelve months this would mean total sales of $70,000,000 contrasted with $68,375,000 for the thirteen months to December 31 last, or at the rate of $61,000,000 for a twelve months' year. This would mean an increase of about fifteen per cent for the year.

There has been some letting up in orders in the East but sales in the middle and far western states continue excellent.

Western Electric is now employing 25,000 persons, compared with 23,464 on January 1 and 17,835 on December 1, 1909. The present number is within 4,000 of the largest payroll the company ever had.

The present policy of Western Electric is to look for increased profits through reduction in cost of manufacturing rather than by increases in selling prices. Unlike most electrical companies Western Electric has made practically no advances in prices of its goods and in numerous cases has been steadily lowering the price, sharing reductions in cost of production with its customers.

Electric Soldering Irons

The electric soldering iron has become a standard implement in the larger telephone exchanges and even the smaller plants are finding great economy and convenience in its use. Its advantages over the common variety of iron are so many, so great and so obvious that little mention need be made of them. Suffice it to say that a well made electric soldering iron keeps its heat constant without variation, and keeps it at the point. As the heat comes from the inside, the copper point of the iron remains cleaner and consequently does better work.

Among the particularly noteworthy irons may be mentioned those made by the Nilson-Dillenbeck Company, Chicago. This company controls patents covering a copper tip protected by a non-corrosive sleeve which is filed away with the copper and protects it from corrosion, besides localizing the heat; separable heating elements; automatic contacts, and an adjustable handle affording long or short reach. Many telephone companies are using Nilson-Dillenbeck irons.

The Automatic Prize Contest

Twelve noon, May 25, closes the prize contest inaugurated by the supply department of the Automatic Electric Company, Chicago, and announced in our last issue. This, therefore, is the last call to would-be contestants.

For the benefit of those who have forgotten, or who missed the announcement last month, we repeat briefly the conditions.

The letters are to present the most convincing arguments why the Automatic Electric Company's condensers and telephone cords are superior. The three prizes are $100, $50 and $25, and will be awarded by a committee of telephone men outside the company. Remember the date, and slip in a prize letter.

Matthews Construction Book

"From the Bottom of the Pole to the Top of the Pole" is the third edition of W. N. Matthews & Brother's telephone line construction book. This time it contains 236 pages and a cover, bound in loose-leaf form, and extremely convenient for carrying in the pocket.

If there is any phase of telephone construction work not covered by this book, with illustrations and diagrams, we have not found it. Even the index contains about 350 references. A number of the informative articles in the book were written especially for this purpose, notably "Flexibility in the Cable Plant and How to Obtain It at the Minimum Cost" and "The Murray, Fisher and Varley Loop Tests," by S. D. Levings, and "Underground Conduit Construction," by S. B. Way. The book should be in every telephone man's pocket.

Star Expansion Bolt Company in San Francisco

Messrs. Otis & Squires, 579-581 Howard street, San Francisco, are now the western sales agents for the Star Expansion Bolt Company, New York, manufacturers of the Sebco products. At the new western headquarters a much larger and more complete stock will be carried, including Sebco expansion shields, Sebco anchors and various other Sebco products. All inquiries from the western field should be referred to Messrs. Otis & Squires, who will give all specifications prompt attention.

Every telephone man has occasion to use toggle bolts at one time or another, and should get the Thomas Wrigley Company's booklet on the subject. The Wrigley toggle bolt has many strong features to recommend it, and the prices seem to be right. The company also manufacturers other specialties, such as emery wheel dressers, pipe benders, blind outlets and steel girder clamps. The company's new street number is 416 South Dearborn street, Chicago.

A report from an American consular officer in Great Britain states that an advertising company in his district has a client who desires to place a large order for electrophone instruments (aids for the deaf), and has expressed a wish to be placed in communication with three or four of the largest manufacturers of these instruments in the United States. He is anxious to hear from such firms as soon as possible. The address will be given on request. Mention file No. 6432.

M. Klein & Sons are sending out a folder showing and listing the "Syracuse" electricians' drill bit and adjustable malleable iron handles, bell hangers' and electricians' drills and toll makers' screwdrivers.

The Premier Electric Company is moving from 521-523 West Van Buren street into its new factory building at Cuyler avenue and West Ravenswood Park, Chicago.

The Specialty Device Company has moved its offices from 1532 Union Trust Building to its factory, in the Murdock Building, 120 Opera place, Cincinnati, Ohio.

Seattle Telephone Properties Valued

C. H. Judson and Frank B. Hall have made a report to A. L. Valentine, superintendent of public utilities, Seattle, Wash., showing the value of the properties and cost of service in that city of the Independent Telephone Company and the Pacific Telephone and Telegraph Company. Previously an investigation had been made for the purpose of ascertaining the probable cost of existing plant; present value after allowing for depreciation; actual cost of operation including all reserves and charges; approximate dividend earned on the investment in the various classes of telephones and the efficiency and adequacy of the service. The cost of the plant of the Independent company, as determined by partial inventory and from company records, was placed at $2,091,672 and depreciation at $607,559, leaving a depreciated value of $1,484,113. A total allowance was made for intangible assets, as follows: Discount on bonds, as per the company's records, $100,000; working capital, estimated, $50,000; cost of obtaining stations during the early construction period, $25,000. The cost of the Pacific company's plant was figured at $2,981,180 and the depreciation at $758,635, leaving a depreciated value for the tangible property of $2,222,545. Intangible assets aggregated $100,000, of which $75,000 was an estimate of the working capital and $25,000 the estimated cost of obtaining stations during the early construction period.

Canadian Commission Cannot Compel Connection

The Quebec Utilities Company holds that the Dominion Railway Commission has not the power to compel one telephone company to grant another company the use of its lines or to fix tolls. This decision was brought about by the application of the People's Telephone Company for the use of the lines of the Canadian Telephone Company. This kind of an agreement had previously been entered into, but the same was terminated in January and the Bell Company entered into an agreement with the Canadian Telephone Compny. Following this adverse decision the People's Company appealed to the Dominion Railway Commission. This body has just rendered a decision in favor of the People's Company, ordering that the exclusive clause in the contract between the Bell Company and the Canadian Company which prevented connection with the People's Company be omitted.

Telephone Tax Bill Passes Minnesota House

In spite of a determined resistance, the Minnette-Schwartz bill placing Minnesotâ telephone companies under the jurisdiction of the state tax committee, passed the house by a vote of 81 to 27.

One amendment, by Rep. N. J. Holmberg, excepting certain classes of mutual telephone companies from the operation of the bill, was adopted.

Representative D. P. O'Neil of Thief River Falls then offered an amendment which was found to be practically a new bill transferring control to the railroad and warehouse commission and omitting the clause applying a penalty for non-observance of the commission's orders. This was killed.

After another futile protest by Rep. Lennon the bill as amended was passed.

Jacksonville to Regulate Rates

Under a suspension of the rules in the house, Representative Chase passed his telephone bill at Tallahassee, Florida. The bill is as follows:

Section 1. That the city of Jacksonville shall have the power, by ordinance, to fix just and reasonable rates which shall be charged for supplying persons within the corporate limits of said city with telephones and telephone facilities, by persons, firms or corporations owning, controlling or operating telephone exchanges or systems in said city, and which shall be used for said purposes; to require, from time to time, the extension of such telephone system or systems, and the extension of such line or lines thereof, and the furnishing of such telephone facilities as the convenience of the residents of said city and the public may reasonably require; to prescribe such rules and regulations for the operation and conduct of such business as may be deemed proper for the purpose of insuring a first class telephone service to the residents of said city; and to prescribe adequate penalties and forfeitures for the enforcement of ordinances passed in pursuance of this act.

Sec. 2. That all laws and parts of laws in conflict or inconsistent with this act are hereby repealed and this act shall take effect from date of its passage and approval.

Omaha Gets Wayside Service

The Omaha Independent Telephone company is installing a system of "wayside stations" and pocket telephones in Omaha.

Three hundred stations will be located in Omaha at intervals of two blocks in the business district and into these anyone with a pocket telephone may plug. The wayside stations will connect with a manual board whose operator will also act as a special "information."

The pocket telephones are of aluminum about six inches by two and one-half. Service has already been contracted for by a taxicab company and the city electrician's office hopes to get a pocket telephone for each of its three inspectors.

Similar service has already been installed and is working successfully in Detroit, Mich., and Rochester, N. Y.

Intermountain Telephone Society Organized

For the purpose of keeping in touch with the departments of business and the scientific development of telephony, the Intermountain Telephone Society has been organized at Salt Lake City, Utah. Membership in the organization for the present is limited to the Bell, Western Electric and Western Union companies. There are forty charter members. Officers chosen at the organization meeting are:

President, W. B. Beveridge; vice-presidents, H. H. Argerbrite and W. E. Clayton; secretary and treasurer, B. Hamilton; assistant secretary and treasurer, W. J. Cronin; sergeant-at-arms, H. H. Wenzell; executive committee, H. J. Bollin, W. W. Stahl, A. W. Steele and T. L. Hammer. The society will meet every second Tuesday in the month.

The consolidation is announced of the *Railway Electrical Engineer*, Chicago, with the *Electric Trunk Line Age*, New York. George W. Cravens, formerly with the General Electric Company, and later consulting engineer in Chicago, will be editor of the shop section, and Carl L. de Muralt, formerly publisher of the *Electric Trunk Line Age*, will be editor of the traction department of the combined papers.

Brevities of the Business

PERSONAL NOTES.

Harry McGill, manager of the Berkeley office of the Pacific Telephone and Telegraph company, has assumed the superintendency of the Palo Alto division of the company with headquarters at Palo Alto.

E. E. Bawsel, a telephone official of long experience, who has been connected with the American Telephone and Telegraph company for a number of years, has been appointed special agent for the Southern Bell company, with headquarters in Atlanta, Ga.

D. M. Therrell, until recently general traffic superintendent of the Western Union Telegraph company at Atlanta, Ga., has been appointed special agent for the Southern Bell Telephone company in that city.

Carl Meneely, for the past two years in charge of the Central Union Telephone company's exchange at Lewistown, Ill., has assumed the management of the company's exchange at Canton.

W. W. Walker of Coatsville, Pa., has been appointed division manager of the American Union Telephone company with headquarters at Hanover.

Francis Lawton, Jr., contract manager of the Chesapeake and Potomac Telephone company, Baltimore, will sever his connection with that company to take a position with the American Telephone and Telegraph company, 15 Day street, New York, N. Y.

Theodore N. Vail, president of the American Telephone and Telegraph company, recently left for a four months' tour of France and Spain.

Charles H. North, of the North Electric company, Cleveland, who has been ill with pneumonia, is slowly regaining his health. Garrison Babcock has been temporarily in charge.

G. L. Saunders, manager of the Interior Telephone company, Grinnell, Ia., has resigned his position to accept a position with the Electrical Contract company of that city. Mr. Saunders will be succeeded by Frank McNally.

P. C. Gettins has been appointed district manager of the Colorado Telephone company with headquarters at Sterling, Colo.

F. J. Hart has been appointed district manager of the Mercer County district of the American Union Telephone company, with headquarters at Sharon, Pa.

Fred Bookheart, of Owosso, who has been in the employ of the Michigan State Telephone company for some years, has been promoted to the management of the Byron office.

F. R. Mott has been elected general manager of the Bell Telephone company of Missouri of St. Louis. Mr. Mott was previously connected with the company for a number of years.

Frank E. Smith of Elmira, N. Y., has been appointed local manager of the New York Telephone company at Corning, N. Y.

N. C. Kingsbury has been chosen vice-president of the American Telephone and Telegraph company and will devote his entire time to that corporation in charge of operation, being located in New York City.

A. L. Cash, Eau Claire, Wis., has been appointed manager of the Wisconsin Telephone company at Beloit, succeeding J. H. Quinlan, who will be transferred to a larger city.

On April 14 B. M. Downs, president of the Electrical Manufacturers' Club, was given a dinner at the Union League Club, New York, by the Brookfield Glass company in recognition of the twenty-fifth anniversary of Mr. Downs' connection with the company. Among those present were the following: Messrs. T. M. Debevoise, lawyer; Frank Brookfield, secretary and treasurer Brookfield Glass company; R. G. Hemingray, president Hemingray Glass company; R. E. Gallagher, secretary New York Insulated Wire company; W. L. Fort, Western Electric company; Electrical World; R. B. Corey, president R. B. Corey company; E. W. Rockefellow, supply sales manager Western Electric company; J. B. Olson, secretary Habirshaw Wire company; E. F. Downs, treasurer and manager United States Can company, Cincinnati; W. Joerger, General Chemical company; W. S. Benedict, Benedict and Benedict, Brooklyn; Herbert Sinclair, Star Porcelain company, Trenton; T. I. Cuyler, assistant treasurer Postal Telegraph Cable; Clarence Winter, lawyer; C. C. Hay, Ingersoll-Rand company; A. H. Pease, president Hart and Hegeman company; A. T. Clark, secretary American Circular Loom company; Walter Cary, manager Westinghouse Lamp company; C. W. Price, Electrical Review; B. M. Downs, vice-president Brookfield Glass company. Mr. and Mrs. Downs left April 18th for Monterey, Cal., to attend a convention of electrical jobbers April 21 to 24.

G. R. Marvin, who has been district traffic chief for the Southwestern Telegraph and Telephone company in Pine Bluff, Ark., has been promoted and transferred to the Texarkana district. His title will be the same, but the district is much larger and more important.

Thaddeus S. Lane, president of the Montana Independent Telephone company, Butte, Mont., has just purchased one of the handsomest residences in Spokane, Wash., and will soon remove to that city to make his home. The home is a beautiful granite structure and was erected at an original cost of $40,000. Mr. Lane will continue to come to Butte at frequent intervals and will continue to have the direct management of the automatic concern in the state. Spokane is more the center of his business activities at this time and for that reason he will make that city his headquarters.

J. M. Portwood has resigned his position as manager of the Macon County Telephone company, Decatur, Ill., and will engage in other business in the Northwest.

E. H. Martin, Webster City, Ia., well known in the telephone field, has recently patented a telephone meter which bids fair to revolutionize the telephone business. It is believed to be a great advancement in the telephone field and it is predicted it will come into very general use.

B. E. Sunny, president of the Chicago Telephone company has been elected president of a group of Bell companies which includes the following: Michigan State Telephone company, Cleveland Telephone Company, Central Union Telephone company, Chicago Telephone company and the Wisconsin Telephone company. Alonzo Burt, president of the Wisconsin Telephone company has been selected vice-president and treasurer.

Angus S. Hibbard, general manager of the Chicago Telephone company, has been appointed a member of the staff of the American Telegraph and Telephone company and after May 1st will leave Chicago to take up his new duties in the office of Theodore N. Vail, president of the company, in New York City. Mr. Hibbard has been connected with the Chicago Telephone company for eighteen years as vice-president and manager. His friends regret that it is necessary for him to leave the city.

William J. McKenna, well known in the electrical field, having been engaged in the business in Chicago since 1890, is a candidate for the position of city electrician under the new administration. Mr. McKenna's experience in this line well fits him for the duties of the position and we trust he may succeed in securing the appointment.

CONVENTIONS.

The Indiana Independent Telephone Convention will be held in Indianapolis May 10 and 11.

NEW TELEPHONE COMPANIES.

Hazle Green, Ala.—The Hazle Green Telephone company has been organized with W. S. McCown president and H. A. Bo Bo secretary and treasurer.

Dover, Dela.—Articles of incorporation have been filed for the Gulf States Telephone company with a capital stock of $25,000. The incorporators are J. M. Satterfield, M. M. Hirons and W. F. Cook.

Springfield, Ill.—The Independent Telephone Toll Clearing company has been incorporated by M. B. Farwell of Bloomington; D. B. Glandon, Pittsfield; Charles R. Peel, Aurora; L. A. Herrich, Freeport. The capital stock is $2,500. The headquarters of the company is Springfield and the purpose is to maintain the toll lines of the Interstate Telegraph and Telephone company in Illinois.

Little York, Ill.—Articles of incorporation have been filed for the Little York Telephone company with a capital stock of $5,000. The incorporators are Willis Wiley, J. E. Porter and C. W. Cooper.

Rockville, Ind.—W. H. Chapman, Bloomingdale; I. T Hobson, Tangier; W. W. Cummings, Marshall; Frank Strong, Judson; William McBride, Portland Mills; O. A. Jeffries, Bellmore; B. A. Wimmer, Mansfield; George J. Adams, Rosedale; John Featherstone, West Union and Elmer T. Welch of Bridgeton,

directors of the various independent telephone lines in Parke county, have organized the Parke County Mutual Telephone Association. The officers are as follows: President, Frank Strong; vice-president, W. H. Chapman; secretary, Elmer T. Welch; treasurer, I. T. Hobson. They adopted by-laws and constitution consolidating the various lines into one general organization. All lines will be connected with the exchange which will be installed in Rockville under a franchise granted the Rosedale Mutual Telephone company. It is expected the system will be complete by October 1, 1911.

HOLTON, IND.—The Holton Telephone Exchange company has been incorporated with a capital stock of $1,200. The directors are L. H. Edwards, Z. L. Ralstin and J. F. Holzer, J. L. Cook, M. M. Shaw, Samuel Shinalt and E. A. Overturf. It is the purpose to operate a telephone system.

NOBLESVILLE, IND.—Articles of incorporation have been filed with the secretary of state, for the Prairie Telephone company which has for its purpose the construction and operation of a telephone system in Hamilton county. The directors of the company are Jacob M. Donald, Wm. Males, O. V. Kelley and Chas. S. Snyder, all of Noblesville.

HENRYVILLE, IND.—The Henryville Telephone company has been incorporated with a capital stock of $3,000. George Ballinger is president of the company.

AURORA, IND.—The Holman Mutual company has been incorporated for the purpose of constructing and operating a telephone system in Holman and Dearborn counties. I. M. Cross is president and J. B. Todd secretary.

NEW LEBANON, IND.—The New Lebanon Mutual Telephone company has been incorporated with a capital stock of $3,500. The incorporators are J. K. Coulson, Arthur Brown, G. D. Staffer, W. R. Willis and J. C. Baughman.

AMISH, IA.—The Amish Telephone company has been organized with the following officers: President, W. J. Scott; secretary, C. C. Yoder; treasurer, Emery Gingerich.

MASON CITY, IA.—The Owens Grove Telephone company has been incorporated with a capital stock of $9,990. The incorporators are A. L. Runyan, Elmer Deach, J. H. Woodward, Evan Jenkins, Renaldo Richardson and S. L. Stevens.

BRONSON, KANS.—A charter has been granted to the Town Telephone company, of Bronson. The capital stock is $5,000 and the directors are O. Love, D. E. Watson, W. W. Peterson, J. P. Mattox and George Broughton, all of Bronson.

GOVE, KANS.—The Hackberry Telephone company has been incorporated by C. E. Hall and Grant Maurer, of Grinnell; V. E. Emerson, Frank Scott, E. L. Fustin and C. M. Scott, of Gove. Capital stock $10,000.

BROWNS GROVE, KY.—The Mayflower Telephone company has been incorporated by J. W. Byrd, W. J. Irvau, J. T. Crawford and F. M. Pea; capital stock $2,000.

DISHMAN, KY.—The Dishman Telephone company has been incorporated with a capital stock of $900 by Henry Siler, S. P. Siler, J. C. Smith, J. B. Siler, N. P. Cupp and J. N. Sharp.

KNOB LICK, KY.—The Phoenix Telephone company has been incorporated with a capital stock of $600 by L. E. Ball, R. T. Pedigo, H. S. Tobey, J. H. Lee, R. C. Lamerith.

SPRING LAKE, KY.—The Spring Lake Telephone company has been incorporated with a capital stock of $500 by Simon Small, W. T. Kelly, James Geary and A. V. McGill.

ELTON, LA.—The Elton Telephone company has been incorporated for the purpose of giving Elton and the surrounding country telephone service. It is capitalized at $5,000 and the directors are: W. H. Tupper, George Kinzer, F. E. Powell, Henry Tietje, George M. Wolverton, Henry Walton, A. H. Anderson, R. E. Powell, and George Walton, all of Elton.

HANOVER, MD.—The citizens of Hanover have organized a telephone and lighting company for the purpose of installing telephone and electric light systems in that place.

LANSING, MICH.—Articles of incorporation have been filed with the secretary of state for the Lacy Mutual Telephone company of Barry county. The capital stock is $4,000.

LAWRENCE, MICH.—The Lawrence Mutual Telephone company has been incorporated.

MURDOCK, MINN.—The Murdock-Carlson Telephone company has been incorporated by Theodore Fredrickson, Alfred Larson, Gust Broden and others with a capital stock of $20,000.

DETROIT, MINN.—The Floyd Lake Farmers' Telephone company has been incorporated with a capital stock of $9,000. The officers of the company are: President, Thomas A. Doherty; vice-president, Byron L. Wheeler; secretary, C. J. Kuehl; treasurer, A. J. Johnson.

SOUTH HAVEN, MINN.—The South Haven Telephone company has been incorporated with a capital stock of $8,000. The officers are: President, Geo. W. Rudolph; vice-president, F. J. Herseen; treasurer, A. T. Forsberg.

MIDDLE RIVER, MINN.—Articles of incorporation have been filed for the Middle River Telephone company. The capital stock is $5,000 and the officers are: Oscar Schenkey, president; John C. Nordlum, vice-president; A. C. Kvennes, secretary and treasurer.

CHESTER, MONT.—Articles of incorporation of the Marias River Telephone company have been filed with secretary of state by L. D. Pugsley, M. Wasesha and J. C. Turner. The company has an authorized capital of $3,600.

BELT, MONT.—The Belt and Tiger Butte Telephone company was recently incorporated by R. H. Bemis, N. Nelson and H. Johnson, with a capital stock of $5,000.

LOUISVILLE, NEB.—Articles of incorporation have been filed for the Cass County Farmers' Mutual Telephone company with a capital stock of $20,000.

BUFFALO, N. Y.—The Grissinger Telephone Repeater company has been incorporated for the purpose of manufacturing and dealing in telephone apparatus. The capital is $100,000 and the incorporators are E. Grissinger, L. A. Grissinger and C. F. Wheeler, of Buffalo.

BROWNS SUMMIT, N. C.—The Browns Summit Telephone company has been chartered for the purpose of maintaining a farmers' telephone system for that territory. The capital stock is $10,000, the incorporators being J. C. Hardie and others.

ELIZABETHTOWN, N. C.—The Bladen Telephone company was recently incorporated with a capital stock of $10,000 and will install an up-to-date exchange in that place.

HAMPDEN, N. D.—The Hampden Mutual Farmers' Telephone company has been incorporated by E. A. Severlid, of Alsen; W. F. Pulford, Martin Mortenson, Thomas H. O'Brien, B. H. Bjerken, W. P. Faulk and A. Benson of Hampden.

CINCINNATI, O.—The Spring Lake Telephone company of Spring Lake has been incorporated with a capital stock of $500 by Simon Small, W. T. Kelly, James Geory and A. V. McGill.

WISNELL, O.—The Harris Grove and Murray Independent Telephone company has been incorporated with a capital stock of $600. The incorporators are M. B. Guthrie, J. F. Key, J. B. Boyd, J. O. Key and O. C. Barnes.

KONAWA, OKLA.—The Orner Telephone company has been incorporated with a capital stock of $500. The directors are John T. Robnett, William I. Walker and Harve McFarland.

CHELSEA, OKLA.—The Riggs Chapel Rural Telephone company is the name of a new company incorporated by William H. Sutherlin, W. J. Strang, I. L. Russell, R. A. Bailey and W. W. Staats of Chelsea, with a capital stock of $2,500.

GATE, OKLA.—The Prairie Dell Telephone company has been incorporated by Larkin Haynes, Charles Kirkhart, S. O. Gordon, Mark Reeves, George Kenneck, C. B. Kirkhart, R. S. Carpenter and Johnnie Sukol, all of Gate; capital stock $600.

ANADARKO, OKLA.—The Sugar Creek Telephone company has been granted a charter. The capital stock is $500 and the directors are John W. Howard, Charles Lamb and Henry P. Schenk.

OKTAHA, OKLA.—The Oktaha Independent Telephone company has been incorporated by J. C. Brady, H. N. Williams, John Newberry and others.

ROSEDALE, OKLA.—John T. Youkum, of Byaers, T. D. Luper, of Paoli, and L. L. Youkum, of Rosedale, have incorporated the Rosedale Telephone company.

HYDRO, OKLA. The Hydro Southwestern Telephone company has been incorporated by Jacob Greenson, D. M. Dill and A. W. Oldham with a capital stock of $500.

KINGFISHER, OKLA.—A charter has been granted the Wandell Telephone company. The capital stock is $500 and the incorporators are J. L. Faxon, J. A. Caylor, C. C. Wells, W. C. Rudd, and T. J. Eaton, all of this city.

DILLSBURG, PA.—The Clear Springs Rural Telephone company has been organized. Among those interested are George A. Dick, George W. Dick, J. W. Baish, W. N. Spahr and Colder Smith.

EPHRATA, PA.—Application has been made for a charter for the Denver and Ephrata Telephone and Telegraph company, by H. F. Esherman of Lancaster. The capital stock is $35,000 and the officers are: President, W. F. Brossman, of Stevens; vice-president, A. N. Landis, of Ephrata; secretary, H. S. Jacoby, Hahnstown; treasurer, C. J. Martin, Martindale. The company will have exchanges in Denver, Ephrata, and Terre Hill.

BENTLEYVILLE, PA.—The Bentleyville Telephone company has reorganized and will ask for a charter. The capital stock is $5,000 and the officers elected are: President, W. H. Murray;

vice-president, Frank Watson; secretary, Leo Wetyler; treasurer, C. K. Frye; directors, J. W. Dague, John Peden, E. G. Ames, E. E. French and Y. A. Heatherington.

Manning, S. C.—I. C. Strauss and Robert Shelor of Sumter, have petitioned for a charter for the Clarendon Telephone company of Manning; capital stock $5,000.

Frederick, S. D.—The Franklin and Frederick Telephone company has been incorporated with a capital stock of $24,970.

Tyler, Tex.—The Talbert Telephone company has been incorporated with a capital stock of $25,000. The incorporators are J. A. Talbert, J. C. Smith and M. Starns.

Winters, Tex.—The Winters and Ballinger Rural Telephone company has been incorporated by J. O. Harrell, R. D. Caldwell and Elgin Davidson; capital stock $15,000.

Tyler, Tex.—The secretary of state has granted the Gulf States Telephone company of Dover, Dela., permission to do business in Taxes with headquarters at Tyler. The concern has a capital of $250,000 and proposes to operate a line through East Texas. S. A. Lindsay will be the company's agent in Texas.

Danville, Va.—The Pittsylvania-Caswell Telephone company has been incorporated with the following officers: President, J. E. Travis; vice-president, J. H. Hodges; secretary, J. W. Faqua; capital stock $3,000.

North Yakima, Wash.—The North Moxee Telephone company has incorporated with a capital stock of $25,000.

Amos, W. Va.—The Amos Telephone company has been incorporated with a capital stock of $5,000 by S. R. Miller, W. S. Swigwe, Clark Jones, J. S. Wyer and D. O. Haner, all of Amos.

Mt. Storm.—The Allegheny Mutual Telephone company has been incorporated with a capital stock of $4,000. The incorporators are R. F. Secrist, of Schert; J. L. Aronhalt, of Germania; J. H. Schaeffer, of Bismarck.

Kewanee, Wis.—Articles of incorporation have been filed for the Ryan Farmers' Telephone company by Fred Arians, Richard Shinnick and Herman Griese; capital stock $4,000.

Merrill, Wis.—The Town of Pine River Telephone company has been organized.

Bellpoint, W. Va.—The Citizens' Telephone company has been incorporated with a capital stock of $5,000 by W. H. Taylor, J. W. Shumate and W. S. Taylor, of Bellpoint; O. L. Foster, Hinton; J. L. McDowell, Bertha; C. G. Ramsey, Forest Hill.

FINANCIAL ITEMS.

Bellville, Ill.—The Shiloh Valley Telephone company has increased its capital stock from $2,500 to $3,000.

Vienna, Ill.—The capital stock of the Johnson County Mutual Telephone company has been increased from $10,000 to $25,000.

Dana, Ind.—The capital stock of the Citizens' Mutual Telephone company of Dana has been increased to $1,200.

Monterey, Mex.—The Monterey Telephone company will increase its capital stock from $250,000 to $500,000 for the purpose of making improvements.

Lincoln, Neb.—The railway commission has authorized the Lincoln Telephone and Telegraph company to issue $488,745 of stock. The company wishes to use $200,000 for the extension of exchanges, $88,745 for extension of long distance lines and $200,000 to invest in associate telephone companies.

Atkinson, Neb.—The Citizens' Telephone company has been granted permission to increase its capital stock from $5,000 to $10,000, the funds to be used for a new building and other improvements.

St. Paris, O.—The Farmers and Merchants' Telephone company has increased its capital stock from $15,000 to $30,000.

Geneva, O.—The Peoples' Telephone company recently incorporated at $10,000 will increase its capital stock to $40,000.

Bryan, O.—The Bryan Home Telephone company has increased its capital stock from $25,000 to $75,000.

Sturgeon Bay, Wis.—The Sawyer and Western Telephone company has filed an amendment increasing its capital stock from $600 to $2,000.

Fennimore, Wis.—The Fennimore Telephone company has increased its capital stock from $6,400 to $10,000.

Sabin, Wis.—The capital stock of the Mill Creek Telephone company has been increased from $3,000 to $15,000.

Pulaska, Wis.—At the annual meeting of the stock holders of the Pulaski Merchants and Farmers' Telephone company it was agreed to increase the capital stock to $20,000. Several extensions will be made during the summer. The officers of the company are as follows: President, Herman Blaser; vice-president, Thomas Lutsey; secretary and treasurer, O. H. Cooley.

CONSTRUCTION NEWS.

Galesburg, Ill.—The Galesburg Union Telephone company has decided to install a modern, up-to-date equipment.

Canton, Ill.—The Home Telephone company is making arrangements to erect a new office and exchange building which will cost about $10,000.

Sadorus, Ill.—The Sadorus Telephone company has authorized the purchase of a site on which it is planning to erect an up-to-date telephone exchange, work to begin about May 1.

Gary, Ind.—The Chicago Telephone company is preparing plans for the erection of a handsome two-story building in Gary which will be used as an exchange and office building and will cost $30,000 to $40,000. There are 1,600 telephones in use and the present facilities are inadequate.

Emmetsburg, Ia.—The Emmetsburg Telephone company will expend $6,000 in improving its system.

Webster City, Ia.—E. H. Martin of the Martin Telephone company, is preparing to erect a new building, a portion of which will be occupied by the telephone exchange.

Hope, N. J.—The Patrons' Telephone company is planning for the construction of telephone lines with Hope as the central office. It is proposed to construct lines to Mt. Hermon, Delaware and Danville, and to connect with the lines already built from Blairstown to Belvidere through Hope.

Roswell, N. M.—It is stated that the Colorado Telephone company which recently took over the local and long distance lines of independent companies in the Pecos Valley, will spend more than $100,000 in improving and extending the same.

Delphos, O.—Directors of the Delphos Home Telephone company will expend about $20,000 in remodeling and enlarging the system.

RATES.

Denver, Colo.—A bill was recently introduced in the Board of Supervisors by George J. Kindel favoring a general reduction on local telephone rates of about 25 per cent. The bill provides for a complete re-arrangement of local rates charged by the telephone company and provides that there shall be no discrimination in prices in favor of any person, firm or corporation in the city. Mr. Kindel stated that in many cases the rates in Denver are 50 per cent higher than other cities the same size.

Kansas City, Mo.—An ordinance providing for the reduction of telephone rates to $21 per year has been introduced into the city council.

Alma, Neb.—The Railway Commission has granted the Farmers' and Merchants' Telephone Company permission to classify telephones in the offices of lawyers and real estate dealers as business telephones, at a rate of $2.00 per month. It has also given the company the right to increase the rate on business telephones in Orleans from $1.50 to $2.00.

Albion, N. Y.—As a result of the consolidation of the exchanges of the New York Telephone company and the Albion Home Telephone company, the rate for residence telephones will be increased from $12 to $15 and business telephones from $24 to $30.

Pierre, S. D.—The Freeman Telephone exchange has made application to the Railway Commission for permission to increase its rates.

Waco, Tex.—The Home Telephone company has petitioned the mayor and commissioners to grant an amendment to its franchise allowing an increase of its rates from $3 to $4 per month, the new rate to take effect when 3,400 paid subscribers have been acquired.

FRANCHISES ASKED AND GRANTED.

Ukiah, Cal.—H. Olsen has been granted a franchise for the construction of a telephone system in First Read District, Mendicino county.

Susanville, Cal.—The California and Oregon Telegraph company has applied for a fifty-year franchise to install a telephone system in this place.

Hillsboro, Ill.—The Montgomery County Telephone company is asking for a twenty-five year renewal of its franchise.

Winnebago, Ill.—The Home Telephone company has been granted a franchise by the village council to build and operate a telephone system.

Newton, Ia.—A franchise has been granted the Murphy Telephone Association.

Ellsville, Miss.—Peter Todd, promoter of a rural telephone system, has been granted a franchise to enter this city.

Evansville, Ind.—Col. William McLean, Henderson, Ky., has submitted a petition for the People's Telephone company to

the Board of Public Works, for a twenty-five year franchise in this city. The applicants agree to give the city 3 per cent of the gross earnings.

SARGENT, NEB.—The Mutual Telephone association has been granted a franchise to install a telephone system in this place.

JARBRIDGE, NEV.—F. H. Winter, A. Z. McCloy, C. S. Andrews and E. C. Murray have applied to the Board of County Commissioners for a franchise to install a telephone system.

TIERRA AMARILLA, N. M.—The Board of County Commissioners have granted the LaBelle Land and Development company a franchise to construct and operate a system of telephone and telegraph lines through the county.

MCMINNVILLE, ORE.—The McMinnville Mutual Telephone Association has asked for a twenty-five year franchise to install a local telephone system.

SPRINGFIELD, ORE.—The Springfield council has granted the Pacific States Telephone and Telegraph company a franchise to operate telephone lines in this city.

WHITAKER, PA.—The Central District and Printing Telegraph company has been granted a perpetual franchise to operate in Whitaker.

TIMBER LAKE, S. D.—Frank E. Sexton, formerly in charge of telephone construction of the North Dakota Independent Telephone company, has been granted a franchise in this city.

MORRIDGE, S. D.—The Missouri Valley Telephone company is seeking a franchise in this place.

HOUSTON, TEX.—The County Commissioners' court has granted the Mackey Telegraph and Telephone company right of way over roads and highways in Harris county.

DAYTON, WASH.—The Commissioners have granted the Mount Vernon Telephone company, composed of a number of farmers, the right to operate a rural telephone line from Dayton to a point near the Wenaha reserve. The forestry department will extend the line into the forest reserve.

TACOMA, WASH.—The County Commissioners have granted to the Sterling Telephone company, headed by G. H. Judges, a 50-year franchise to operate a line over the county roads. The company is composed of farmers of the county and the line will connect with the Home company in this city.

CHICO, CAL.—The Home Telephone Company, through its representative, John Leeper, has applied for franchises in Oroville, Chico, Red Bluff and other cities in Butte county.

BAKERSFIELD, CAL.—The supervisors of the county have granted a franchise to the town of Lost Hills.

ROCKVILLE, IND.—The Rockville town board has granted the Rosedale Telephone Company a 25-year franchise to operate in that city. The company agrees to put in a metallic system, the work of construction to be completed by October, 1911.

ELKHART, IND.—The Home Telephone Company has applied for a new franchise. The company is preparing plans for a new exchange building and the installation of an automatic switchboard.

STANFORD, KY.—Herbert Kinnaird has secured a telephone franchise in this place.

PORTLAND, IND.—The Como Telephone Company has been granted a franchise by the city council to install a telephone system in this place.

GENEVA, OHIO—The Peoples' Telephone Company has presented a petition for a franchise in this city.

MCMINNVILLE, ORE.—The McMinnville Mutual Telephone Association has petitioned the city council for a 25-year franchise. This is a new corporation consisting of the various farmer telephone lines throughout the county.

VALE, ORE.—R. S. Johnson and associates have been granted a franchise for a telephone system in this city. A company will be formed.

GREENVILLE, UTAH—The citizens of Greenville have petitioned the board of county commissioners for a franchise for a telephone and electric light line from Logan to that place.

MORRIDGE, S. D.—The Missouri Valley Telephone Company has been granted a franchise to install a telephone system in this place.

TACOMA, WASH.—G. H. Judges, A. Miller and James Long, representing the Sterling Telephone Company, have filed application for a franchise to install a telephone line in the western and southern part of the county, with the county commissioners.

LUSK, WYO.—M. E. Shipley of Hooper, Neb., and W. B. Shipley of this place, have asked the city council to grant them a franchise to install a telephone plant here.

MILLIKEN, COLO.—The trustees of Milliken have granted a twenty-year franchise to the Colorado Telephone Company. By the terms of the franchise the trustees may require the company to place its poles so as not to interfere with traffic and the company must give bond in the sum of $10,000.

INDEPENDENCE, CAL.—The Owens Valley Improvement Company has asked for a franchise to install a telephone system in Lone Pine and Independence and the same will be offered for sale March 7.

BUSHNELL, ILL.—Attorney Rufus Lybarger, representing A. L. Florey and F. W. Copeland, has petitioned the city council for a twenty-year franchise to establish and conduct a telephone system in Bushnell.

PORTLAND, IND.—The city council has granted a franchise to the Como Telephone Company, which proposes to install a telephone system here. It is provided that the company shall supply the city with six free telephones for fire service and that it shall operate free, a police signal light and fire alarm system from the central office.

OGDEN, UTAH.—The Davis County Telephone and Electric Light Company is seeking a franchise to operate an electric light plant and a telephone system. A committee appointed by the Chamber of Commerce to assist in securing the franchise consists of the following: H. Rolapp, O. A. Parmley, S. S. Smith, O. A. Kennedy and J. J. Brumitt.

SUMNER, WASH.—The Pierce County Commissioners have granted the Equality Telephone Company permission to construct a telephone line between Sumner and Dieringer, connecting with the Sunset system at Sumner. The trustees of the company are as follows: George W. Edwards, A. A. Hook, W. H. Pierce, Ivan Atkinson and W. H. Wilson, all R. F. D., Sumner.

MISCELLANEOUS.

LITTLE ROCK, ARK.—The Arkansas Sublicensee Telephone Association recently held a meeting in this city at which time a constitution and by-laws were adopted and matters of importance to the telephone business in Arkansas were discussed. The officers of the association are: President, A. B. Banks, Malvern; vice-president, E. H. Frisby, Malvern; secretary, John Frisby, Morrilton.

ORLANDO, FLA.—The Brevard County Telephone Company has been purchased by a company of which J. E. Reed is president and A. A. Buck secretary and treasurer.

ROCKFORD, ILL.—The Rockford Home Telephone Company has elected the following officers for the coming year: President, T. M. Ellis; vice-president, R. S. Chapman; secretary, John H. Camlin; treasurer, F. F. Wormwood; directors, F. H. Worthington, C. L. Miller, E. E. Bartlett, Dewitt H. Taylor, Bethune Duffield, the last two of Detroit, and W. G. Shrap of Elyria, Ohio.

MACON, ILL.—O. E. Daggett is now sole owner of the Mt. Auburn Telephone Company and the Macon Telephone Company, having recently purchased both.

MODALE, IA.—At the annual meeting of the Interstate Telephone Company the following officers were chosen: President, W. A. Smith; vice-president, F. M. Terry; secretary and treasurer, H. M. Silsby.

BATTLE CREEK, MICH.—At the annual meeting of the Citizens' Telephone Company, Manager H. H. Taylor reported that he is rushed with orders, and is unable to fill them as fast as they come in and that the prospects for the coming year are especially good. The old officers were re-elected and are as follows: President, E. B. Fisher; vice-president, Lycurgus McCoy; treasurer, W. S. Keet; secretary and general manager, C. E. Tarte.

ALMA, MICH.—The Union Telephone Company reports the year just closed as the most prosperous in the history of the company since its organization 16 years ago, having realized 8 per cent on its investment. The officers re-elected are; President, C. T. Babcock; vice-president, E. S. Wagar; treasurer, U. S. Ward; secretary, L. L. Conn; general manager, W. J. Melchers.

MIAMI, MO.—The Miami telephone system has been purchased by W. E. Dickerson.

WEST PLAINS, MO.—The West Plains and Howell telephone system has been purchased by J. W. Boyer and L. F. Boyer, who will improve and extend the same.

BROOKLYN, N. Y.—Judge Hand has appointed Jesse Watson receiver for the Radio Telephone Company, with a bond of $1,000.

MCCONNELLSVILLE, OHIO.—The Riverside Telephone Company has taken over the new plant of the Citizens' Telephone Company at this place.

LA GRANDE, ORE.—A deal has been consummated whereby the exchanges and equipment of the Pacific States Telephone and Telegraph Companies in Union and Wallowa counties have been transferred to the Home Independent Telephone Company. This means an addition of 1,200 subscribers, making 2,200 for

the Home company, which hopes soon to increase the number to 3,000. The transaction is said to involve over $200,000.

SPRINGFIELD, OHIO.—On the application of a number of the stockholders of the American Automatic Telephone Company of Urbana, Judge A. H. Kumkle has appointed A. F. Vance and T. A. Edmondson receivers for same and the bond of each has been fixed at $100,000.

BOSTON, MASS.—Arrangements for the annual meeting of the Association of Railway Telegraph Superintendents to be held in Boston, June 19 to 23, have already assumed definite shape and plans for the entertainment of members will be worked out. The Boston and Maine Railroad of Boston has tendered a special train to some points of interest on its line, and the New England Telephone and Telegraph Company has also expressed itself as willing to aid in a special manner in their entertainment.

NEW YORK, N. Y.—An effort is being made to form an organization of the Telephone Pioneers of America. The requirements are "employment in the telephone service twenty-five years prior to date of application and continuously at any time thereafter for five years." Letters of application may be forwarded to Henry W. Pope, American Telephone and Telegraph Company, 15 Dey St., New York, N. Y.

WILKESBARRE, PA.—A complete telephone system has been perfected in the anthracite mines of this section.

LOYALSOCK, PA.—The Loyalsock Telephone Company has decided to make extensive improvements in its system.

SALT LAKE CITY, UTAH.—At the annual meeting of the stockholders of the Rocky Mountain Bell Telephone Company the following officers were elected: President, H. Vance Lane; vice-president and treasurer, W. S. McCormick; secretary, R. B. Harkness; auditor, P. R. Ferguson; assistant treasurer, John Flowers; assistant secretary, S. E. Hamer.

RACINE, WIS.—The Citizens' Telephone Company has been purchased by the Wisconsin Telephone Company at a consideration of $110,000.

MACON, MO.—Theodore Gary, who formerly owned and operated the telephone system in this city has disposed of his interest to R. A. Guthrie. who, it is believed, will maintain the high standard attained under Mr. Gary's efficient management.

WEST PLAINS, MO.—The West Plains and Howell Telephone Company has been purchased by J. W. Boyer and L. F. Boyer, who will make many improvements in the system.

LINCOLN, NEB.—The Railway Commission will hold a hearing Friday, March 10th, for the purpose of considering business methods of telephone companies doing business in Nebraska, particularly the matter of rates and regulations covering added exchange or country service.

JERSEY CITY, N. J.—Upon application of Ex-attorney General Robert H. McCarter, of New Jersey, Vice Chancellor Garrison, sitting in Jersey City, has named Frank P. McDermott receiver for the Continental Telephone and Telegraph Company of New Jersey, a company organized for the purpose of holding and controlling various independent telephone concerns.

UTICA, N. Y.—At the annual meeting of the Utica Home Telephone Company the following officers were elected: President E. B. Odell; vice-president, H. F. Miller; treasurer, W. I. Tabor; directors, the above officers and G. R. Fuller, J. Craig Powers and F. W. Zoller of Rochester; H. S. Holden of Syracuse and C. H. Poole of Utica. The Denio General Electric Company was given permission to use its telephone fire alarm system in connection with the Home telephones. This is an ingenious device by which any house is connected through to headquarters by using the telephone circuit already in the building.

ALBANY, N. Y.—Petitions have been received by the Public Service Commission from the New York Telephone Company asking that it be permitted to buy the Amsterdam Automatic Telephone Company for $150,000, to merge the Trumansburg Telephone Company, the Jefferson County Telephone Company, and to transfer the rights, property and franchises formerly belonging to the Central New York Telephone and Telegraph Company, now owned by the New York Telephone Company, to the Otsego and Deleware Telephone Company for the sum of $98,000. Also to sell its property in Allegany county to the Allegany Telephone Company of Wellsville for $35,000.

PITTSBURG, PA.—William Flinn and Joshua Splane have been appointed receivers for the Pittsburg and Allegheny Telephone Company, one of the largest independent telephone companies in the country. The bond was placed at $125,000. The petition was filed by H. V. McCullough, a stockholder.

YORK, PA.—As shown by the financial report given at the annual meeting of the York Telephone Company the past year has been one of the best years in the company's history. Officers for the coming year were elected as follows: President, C. C. Frick; vice-president, Hon. D. F. Lafean; secretary and treasurer, H. H. Weber; general manager, George B. Rudy; superintendent, H. L. McNeal.

PHILADELPHIA, PA.—In a suit brought by John E. Stevenson, a stockholder of the Continental Telephone and Telegraph Company, in common pleas court, Judge Wilson appointed Charles E. Wilson receiver and his bond was fixed at $100,000. The principal office of the company is Jersey City.

BRADY, TEX.—Messrs. Spiller and Spiller, of Waco, have purchased a half interest in the Brady telephone system, the consideration being $15,000.

VAN HORN, TEX.—The local telephone system has been purchased by W. P. Geadslin and Whit Roas.

AMARILLA, TEX.—Owing to the similarity of its former name to that of the local telephone system the Northwest Texas Telephone Supply Company has changed its name to the Nunn Electrical Company. The company conducts a wholesale business in electrical supplies, selling to numerous light plans, contractors and telephone exchanges.

MILWAUKEE, WIS.—The electrical supply house of Julius Andrae & Sons recently sustained a heavy damage from fir.e The loss, however, was fully covered by insurance.

MENA, ARK.—The Kiser Telephone company of this place has been taken over by the Southern Telephone company.

GILROY, CAL.—The Gilroy Telephone Company has purchased the Pacific Telephone Company's system in Gilroy and vicinity and will make some necessary improvements. One of the most important of these is that of placing some of the wires in cables.

WILLIAMS, CALIF.—The telephone system in this place has been purchased by A. M. Harris.

DENVER, COLO.—The Colorado Telephone Company has acquired complete control of all independent telephone concerns in the Pecos Valley, N. M., and on April 1st assumed charge of same. The deal involved an expenditure of $350,000. The companies taken over are the Roswell Telephone and Manufacturing Company, Chaves County Telephone Company, Artesia Telephone Company and Roosevelt County Telephone Company.

BOWDEN, GA.—The Bowden Telephone Exchange has been purchased by the Gainesboro Telephone Company.

ALBANY, ILL.—The Albany Telephone Company has elected the following officers: President, H. R. Lenion; vice-president, Thurston R. Adams; secretary, Charles E. Peck; treasurer, Charles A. Olds.

OAKLAND, ILL.—The Oakland Telephone Exchange has been purchased by William Grimm, who will make extensive improvements in the plant. The consideration was $12,000.

CANTON, ILL.—At the annual meeting of the Home Telephone Company plans were outlined for extensive improvements and increased capacity. The old officers were re-elected and are as follows: President, M. J. Gorman; vice-president, G. W. Chandler; secretary, F. W. Plattenburg; treasurer, W. D. Plattenburg; manager, P. P. Anderson. The improvements will include a new exchange building.

JACKSONVILLE, ILL.—The Illinois Telephone Company has elected officers as follows: President, Dr. J. C. Widenham; vice-president, Judge C. A. Barnes; secretary, R. A. Gates; treasurer, W. W. Ewing; general manager, W. W. Holliday.

FT. DODGE, IA.—At the annual meeting of the Iowa Independent Telephone Association recently held in this city, J. C. Thorne of Fairfield was elected president and W. J. Thill of Des Moines was re-elected secretary-treasurer. The executive committee is composed of J. M. Plaister of Fort Dodge, H. S. Baker of Sioux City; C. Anderson of Corning; H. B. Shoemaker of Toledo.

WEBSTER CITY, IA.—E. H. Martin will erect a new fireproof telephone building at a cost of $12,000.

TURON, KANS.—The telephone exchange of this place has been purchased by G. D. Nelson.

ALMA, MICH.—At the annual meeting of the Union Telephone Company the following officers were elected: President, C. F. Babcock, St. Johns; vice-president, E. S. Wager, Edmore; treasurer, G. S. Ward, Alma; secretary, L. L. Conn; general manager, W. J. Menchers, Alma. The report of the secretary showed the past year to have been the most successful and progressive in the history of the company. There was a gain of 1,187 for the fiscal year, making a total of 10,662 subscribers.

GUERNSEY, UTAH.—The Guernsey Telephone Company and the Platte Valley Telephone Company have been consolidated under the management of Walter L. Diver.